THE STORY OF THE AEROPLANE

Mr. Claude Grahame-White

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BY

CLAUDE GRAHAME-WHITE

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THE BEGINNINGS OF FLIGHT

Date.	*Miles.*	*Time in Air.*
1903	0.98	59 sec.
1904	3.00	5 min. 27 sec.
1905	24.20	38 min. 13 sec.

For the first chapter of a book on flying, and particularly of a book which is to be read by Americans, I could not, I think, do better than to make a beginning with the little table which I have set out above. It tells, in itself, in the clearest possible way, the endeavor of two men whose names will be remembered as long as the world lasts — Wilbur and Orville Wright.

For their country, these two pioneers have done a very great thing. They have ensured that, whenever flying is under discussion, America must take a pre-eminent place.

These two brothers have made the month of December, 1903, a memorable one in history. It was in this month that they achieved their first flight with a power-driven aeroplane. In the

following three years, the brothers made some 160 flights, learning useful lessons by each one.

The story of the Wright brothers is a singularly fascinating one. Their work has always been, in my opinion, typical of the spirit of America. That spirit is "thoroughness." These two brothers had no special facilities for the great task which they set themselves. It would have seemed, at the beginning, as though their efforts must be doomed to failure. But they did what I have noticed that the majority of successful men in America do. Instead of making their work a toil, they made it a pleasure. Nothing was too much for them. No piece of research was too arduous. The result was that they built a flying machine which is, even in these days of progress, a wonder of efficiency.

The flights set out above express, at a glance so to speak, the record of the marvelous work done by these two quiet, determined men. In our view, to-day, when flights of many hours' duration have become an accomplished fact, the first triumph, that of remaining in the air for a period of 59 seconds, has a peculiarly striking effect.

One can imagine the feelings of quiet triumph of these two men, who had worked for years in solitude, when they were able to pilot through the air the first power-driven aeroplane.

The way in which the Wright brothers sought

Mr. Grahame-White shaking hands with Mr. John Townsend Trowbridge, the author of "Darius Green and His Flying-Machine," at the Harvard-Boston Aviation Meet, Atlantic, Massachusetts, September, 1910

to elucidate the problems of flight was, in itself, typical of them. They set to work in a purely methodical way. Without beginning, as some experimenters have, at what one may call the wrong end of the stick — that is to say with a power-driven machine — they determined to devote exhaustive tests to machines which were known as "gliders," and which are not equipped with power.

What they learned by their tests with "gliders" may, perhaps, be summarized in the following way. They learned that a machine constructed of planes, with a "camber," or curve, on these planes best suited to get a maximum of "lift" out of the air passing beneath it, will glide through the air, providing it is moving forward fast enough to obtain support out of the air, and also that this machine can be controlled, while in a gliding flight, by movements of small subsidiary planes.

Nor did this comprise all that they learned in their glider work. This preliminary flying taught them many valuable lessons regarding the distribution of the weights upon a machine. They also required very valuable knowledge concerning what "camber" on a plane gave the best lifting results, having regard to a certain area of surface.

One must take it, I think, that these brothers were the first men in the world to make a satis-

factory application of motive power to an aeroplane. After they had experimented, with extraordinary patience, with all forms of gliders, and had been undeterred by countless failures, they decided that the time had come to fix the most perfect of their gliders with an engine and propellers and attempt a power-driven flight. For power, they used a four-cylinder engine of an extremely simple design, which drove two propellers. It was with this first machine, a crude construction when viewed with the eyes of 1911, that they made a leap through the air of 0.98 of a mile.

Fifty-nine seconds in the air! Men more enthusiastic and less self-restrained than were these two brothers, would have been unable to proceed methodically after this. They would have sought the world, and would have declared their triumph.

As it was, however, they said nothing. All they did, in fact, was to plan very much more efficient work, and to allow a year to go by.

Their strength of mind is wonderful to contemplate. For all they knew, at that time, some other man, or men, might have been forestalling them in their great achievement.

In 1904, we find their further experiments bearing fruit. Now we have a flight of three miles. After this, evidently, the brothers made astonishing progress, for in the next year they succeeded at flying, at a height varying from

Mr. Ralph Johnstone, Mr. Walter Brookins, and Mr. Wilbur Wright

seventy-five to one hundred feet, for a distance of 24.20 miles. During this flight the machine was more than half an hour in the air.

The conquest of the air! But, of course, there are important reservations. The air has not yet been conquered, although, writing as I do in the beginning of 1911, flights of eight hours' duration have become an accomplished fact. It is not the air, but the gusts of wind that pass across the surface of the earth, that constitute the airman's foe. Until, by gradually increasing speeds, it is possible to fly in winds that now chain us to the ground, it will not be possible to say that the task which the Wright brothers began has been brought to a completely successful issue.

After astonishing America with these early flights, the Wright brothers separated temporarily. Wilbur Wright went to Europe. Here, although people were interested, they were frankly sceptical. But Wilbur Wright, indomitable and reserved, soon proved that his were no idle claims. His flights in France aroused the wildest enthusiasm.

And what has happened since then, in connection with the work of these two wonderful men? After their first achievements, they were busy, for some time, organizing flying schools and selling their machines to various governments. Now they are experimenting again.

"Still at work!" as one of their friends described them to me when I was in America. This is typical of them. The Wright brothers represent a type that is almost unique in the flying world. They are never beaten. They are always thinking things out. And I have no doubt at all but that they will again make the world wonder with some new idea.

Many people, who are not technical, and who have discussed flying with me, have expressed wonder why it was, after so many, many years of striving, that man should suddenly find success in aerial navigation.

The explanation, like many other explanations of a strange thing, is simple. The difference between flying, and not flying, was purely one of motive power. Years before man actually flew it had been possible, by means of gliding machines, to determine what shape planes should be, and also how an aeroplane might be controlled in flight. All this work, as I have said, had been done. But men were no nearer their goal than they had been before. The engines which were available to propel their machines were too heavy.

An illustration to make this point clear is possible. The lightest steam engine that could be employed, as the motive power, for one of the early type aeroplanes weighed 10 lbs. for every horse-power of energy which it produced. Nowadays, one of the best petrol motors used on aero-

planes weighs only about 3½ lbs. for each horsepower.

Here you have the secret. In this lies the difference between success and failure. As soon as man discovered the ideal form of motor for his aeroplane, he began to fly. Although I have shown that the Wright brothers were flying in 1903, one finds that very important preliminary work was being carried out ten years before any real success came.

Lilienthal, whose name will never be forgotten in the annals of flying, and who began his experiments in 1871, was performing gliding flights long before power-driven flight was possible. In one of them Lilienthal flew, or, rather, glided through the air for a distance of more than 100 yards, at a height of some seventy-five feet. He used an arrangement of planes or wings, which he held around him, and with which he precipitated himself from a hill, gliding down the side of it against the wind. Lilienthal's pioneer work was unfortunately cut short, in 1896, owing to the fact that the wind — the airman's implacable enemy — overturned his glider while in a flight, and he was killed.

One of the most interesting experiments in England in the early days of flying was that carried out by Sir Hiram Maxim. He constructed, in 1894, a very large machine which cost, to construct, a sum of close upon £20,000.

The machine, roughly described, comprised one large lifting plane with a number of smaller planes. Altogether the area of the lifting surface of the machine amounted to 3,875 square feet. The framework of this very large machine was not built of wood, as is the case with the aeroplanes we have at present, but went a stage further even than we have done — being constructed of steel tubes. The machine was driven by a specially lightened steam engine which developed 350 horse-power and weighed 700 lbs. Altogether the aeroplane weighed well over three tons.

This highly ambitious experiment was productive of some very interesting results. In order to give the machine a run along the ground before rising into the air, a miniature railway line had been constructed. The aeroplane was fitted with wheels and designed to move along this line.

Sir Hiram Maxim went very carefully, beforehand, into the question of how the machine should be controlled, should it lift into the air.

As a matter of fact, no very clear idea could be obtained as to what would happen to the machine should it actually lift and move off through the air. To obviate the danger of an accident from this cause an overhead rail was fitted. Wheels were fitted on the machine to come in con-

Mr. Brookins Mr. Wilbur Wright
Mr. Wilbur Wright and Mr. Walter Brookins bringing out a Wright biplane for a flight by the latter

tact with it, and so prevent the aeroplane rising more than a few feet.

With this machine, heavy though it was, what one may call controlled flights were made. On several occasions the machine lifted until it touched the upper rail. Unfortunately, after some experiments had been carried out, the apparatus was wrecked.

Professor Langley, a man who had taken the most profound scientific interest in the development of flying, did some exceedingly interesting work in America in 1896. He was a great believer in working with models. On one test, of which I have a note, he produced a large working model which is said to have flown for a distance of no less than four thousand feet. This was an extraordinarily good performance.

References to these early pioneers are not complete without mention of the imported gliding work of Chanute, who became the aeronautical mentor of the brothers Wright, and whose biplane glider provided the brothers with their first experimental type machine.

There is no doubt that a great deal of valuable work in connection with aeroplaning can be achieved with models — despite some statements that have been made to the contrary. For a man who is intending to build an aeroplane the making of a series of models first is most instructive. One can, for example, determine very effectually,

by means of a model, what the gliding angle of a completed machine will be. It is also possible, with the aid of models, to estimate very accurately what will be the effect in a full-sized machine of any experimental form of elevating planes or rudder.

For this reason, I have always been only too glad to further, so far as has been in my power, any project concerning the institution of model aeroplane clubs. Of these there are a number in England and in America. Their membership comprises men as well as boys. A great deal of very useful knowledge can be gleaned in a pleasant way by the flying of models. Langley's experiments produced a great deal of interesting data concerning the shapes of planes.

Preliminary work with gliding machines was carried out in a very practical manner by Pilcher, an Englishman whose name will be remembered with that of Lilienthal. Pilcher made a very great number of glides and determined some very useful points, especially regarding the stability of aeroplanes. But, unfortunately for himself, he shared the same fate as did Lilienthal, his predecessor. Pilcher was performing a long glide when his machine was attacked by a sudden gust of wind. This caused him to lose control of it, and it was dashed to the ground, with fatal results for its pilot. In these days, when we have to remember that there have been thirty-five

A Curtiss biplane

aeroplane fatalities up to April 1, 1911, it is very significant to remember that, even with such simple apparatus as these two men were using, there was a grave danger in purely experimental work.

CHAPTER II

EARLY WORK IN EUROPE AND THE DEVELOPMENT OF PILOTS AND MACHINES

The men who have actually evolved new aeroplanes — men like the Wright brothers, Farman, and Bleriot for example — should be specially thanked for their labors. The men who have taken over their work, and flown upon machines which they have evolved, have not done so notable a thing, seeing that they have not taken so grave a risk.

One instance of this point is sufficient. Bleriot, while experimenting with the monoplanes which he finally brought to such success, had one fall after another, due to the fact that he was experimenting either with some new engine, some new form of wing, or with some fresh method of control.

The men who began to fly upon Bleriot's monoplane afterwards, although they have done much to further the industry, cannot share with him the same laurels as pioneers. I have mentioned this point because I think we are sometimes rather prone to forget in the triumph of present achieve-

ments what these first masters of flight really were able to achieve.

From 1899, when Pilcher was "gliding," we come to a peculiar form of bat-like machine which was used in the next year, 1900, by a Frenchman named Ader. This experimenter had planes which were in the shape of wings, and his whole apparatus weighed something over half-a-ton. It lifted, actually flew a little way, and then came to grief.

One very curious fact occurs to me in this connection. When one reads of the work of these very early pioneers, one is struck by the fact that many of them appeared to think that no period of what one might call tuition in flying would be necessary.

In several cases, very large and heavy machines were built as first models. With these, apparently, the inventors hoped to be able, when they got into the air, to learn the control of their machines instinctively. How they could have hoped to do this I can hardly see.

In some cases, with machines weighing nearly a ton, had they actually flown any appreciable distance, they would have been bound to come to grief by failing to control the machines in the new element in which they found themselves. With present-day aeroplanes, it is necessary for a pupil to run about on the ground for some appreciable time before he dares to raise himself into the air.

During this ground practice, he accustoms himself to the operation of the controlling mechanism of the aeroplane. His first flights, of course, when he makes them, are very brief ones. He gradually learns confidence in the air in the same way as does a young bird which is just learning to take to its wings.

In considering the earlier European experimenters, let me now turn to a very famous figure in the world of flying — M. Santos-Dumont, the agile and daring Brazilian sportsman who has done so much to further the conquest of the air. At Bagatelle, in October of 1906, M. Santos-Dumont was experimenting with a very queer machine — queer at least when viewed in comparison with the machines which we now possess.

It was very much like a big box-kite, with a sort of junior box-kite in front of it to act as an elevator. The whole construction ran on bicycle wheels, and was propelled by a motor which weighed 130 lbs. After innumerable experiments with this machine M. Santos-Dumont succeeded in flying, or rather in "hopping" across the ground, for a distance of about eighty yards.

This feat was acclaimed at the time as a most wonderful one, and was the cause of the keenest attention being directed to the young Brazilian's next performances.

In the following month, perfecting his apparatus a little, he was able to make a " flight " of one hundred and sixty yards. At this there was the greatest enthusiasm. This, it should be remembered, was in 1906. Now, only a little more than four years later, we read almost every day of flights of three, four, and five hours being made. It is illustrations like these which show us how rapid has been the development of flight.

Following upon his one hundred and sixty yard flight, Santos-Dumont was able, in the same month of November, 1906, to make what was acclaimed as a " world's record."

He flew for a distance of 230 yards. While making this aerial journey he remained in the air for twenty-one and one-fifth seconds. His speed during this memorable effort was stated to be at the rate of twenty-five miles an hour.

In this connection, one can also illustrate the progress that has been made since then. From twenty-five miles an hour speeds crept to thirty, from thirty to forty, from forty to fifty, and then up to over sixty miles an hour. Recently a flight was recorded in which the speed of the machine was close upon eighty miles an hour!

After Santos-Dumont had thus created his 230 yards world's record, progress in Europe was slow until the following year, 1907. Designers and makers had, however, been busy in

the meantime. Notable amongst those who were experimenting very carefully in this new field were the Voisin brothers, who carried out a number of experiments with gliding machines.

They produced an exceedingly interesting machine. This machine of theirs had two supporting planes, with a front elevator, and a tail something in the form of a box-kite. In the center of the machine was a petrol motor, which actuated a metal, two-bladed propeller.

When this machine was ready to be flown, there naturally came the need to find a pilot who would steer it. This proved to be Mr. Henry Farman, who had been making himself famous as a racing motor-driver, and who afterwards became one of the world's most renowned airmen. He took this first biplane of the Voisins' to the large military parade ground at Issy-les-Moulineaux, near Paris.

After a good deal of delay, due to the work necessary in tuning up the machine, Mr. Farman flew for a distance of 311 yards. With this feat, he eclipsed the "world's record" of M. Santos-Dumont, who had, as I have just said, flown for 230 yards at Bagatelle just about a year before.

This flight of Mr. Farman's was but a prelude to a regular series of aeroplane triumphs. Thirteen days after he had flown 311 yards, Mr. Farman rose off the ground and flew for 843

yards in two stages. In the first he was in the air for twenty-seven seconds, traversing 383 yards. In the second stage he flew 440 yards in thirty-one and one-half seconds.

This idea of making a flight of 843 yards in two stages is humorous to us nowadays, particularly when one remembers that Paulhan's famous London to Manchester flight of 183 miles in 1910 was performed with only one halt. But these flights of Farman's attracted all Paris to Issy, and were the means, in addition, of stimulating the interest of the entire world.

After a little more experimental work, Mr. Farman eclipsed all his previous achievements. It was on January 11, 1908, that he was able to demonstrate to the people of Europe that the aeroplane could really fly. Starting away with his aeroplane flying very well, Mr. Farman was able to remain in the air for a period of 1 m. 55 s.

This performance, although it would be eclipsed nowadays by the first flight of the veriest novice, was regarded, in those pioneer times, only three short years ago, as being something altogether remarkable. Crowds came out to Issy to see this wonderful man and his even more wonderful machine.

Two days later, on January 13, Mr. Farman went a stage further. He was able to fly for a kilometer, and while doing so to effect a turn in the air. This was the first time that he had been

able to do anything except short, straight flights. By making this semicircle he won a £2,000 prize and also a £100 award from the *Daily Mail*.

After these days, progress with flying began to be very rapid. Once it was found possible to get a power-driven machine into the air, progress was represented chiefly by the pilot's ability to keep his engine running. Upon these engines the greatest care was expended. It was not long before flights of half an hour were made. The year 1908 was, indeed, remarkable for the gradual lengthening of aeroplane flights, and for the fact that aeroplane engines were beginning to be made reliable.

This leads me to the year 1909. This will be remembered as a year of great public exhibitions of flying. The first of the wonderful Rheims weeks was held with extraordinary success. Flying meetings took place in all parts of Europe. People really began to awaken to the new wonder which had dawned. No more significant feat was achieved than that of M. Bleriot, when he first crossed the English Channel by aeroplane on the morning of July 25, 1909. The year 1909 also saw the institution of regular flying schools, to which pupils thronged in order to be taught to handle the chief types of machines.

While 1909 showed what aeroplanes could do when flying round aerodromes, 1910 may be

taken to have been the great "cross-country" year. Aeroplanes flew over towns and country. Engines became so reliable that feats of cross-country flying, undreamed of the year before, were attempted by many airmen.

A notable event of the year, of course, was the winning of the *Daily Mail* £10,000 prize for a flight in England of 180 miles from London to Manchester by M. Louis Paulhan — with whom, it may be remembered, I had the honor to compete. The year 1910 also showed, for the first time, in the French maneuvers and elsewhere, the military potentialities of the airman.

The year was important also for the remarkable growth of the number of flyers. One estimate made at the end of 1910 put the total number of men in the world who could pilot a power-driven aeroplane at close upon three thousand.

One of the most picturesque personalities in the world of aviation is Mr. Hubert Latham, whom Americans have had an opportunity of seeing. Mr. Latham's reputation was made in the early days of flying, not by the length of his flights, but by the fact, that he ventured aloft in winds which proved too great for any other pilots. Contributing to his success in this direction was the stability of his Antoinette monoplane, and also his own great personal skill.

In appearance, Mr. Latham does not suggest

his wonderful dash and nerve. He is slight, with a rather pale face, and dark, somewhat speculative eyes. He is generally smoking a cigarette and, if he be talking with others, he is probably speaking very quietly, and with an occasional shrug of the shoulders. These things are characteristic of him.

The eternal cigarette is apparently an indispensable accompaniment to his conversation, and also to his flights. This quiet, almost abstracted, young man is one of the finest airmen of the day. He has already done many stimulating things in his life, and he is now exceptionally keen upon the newest sport of the day — airmanship. Mr. Latham has been a big game hunter, and he is an expert motorist. Above all, he is an airman of extraordinary delicacy and skill. His introduction to the flying world was typical of him.

The Antoinette monoplane, although a most interesting and efficient machine, apparently requires a good deal of skill in the handling of it. In its early days it suffered somewhat, because it was not possible to find any sufficiently expert pilot to reveal what it could do. At this juncture, Mr. Hubert Latham became interested in the machine, and decided to learn to fly it.

After a few trials, Mr. Latham astonished the makers of the machine by the rapid way in which he learned to control it. In a very short time he

was completely master of the monoplane, and was able to display to the full the capabilities of the machine, particularly its stability when flying in a wind.

When in Latham's hands, with its wide-spread wings, and graceful tail planes, the monoplane has a really striking resemblance to a bird in flight. This beautiful flying of the Antoinette was a striking feature of the first Rheims meeting. Whereas, when others came past the stands, there was generally very little in the way of applause, the appearance of this monoplane was the occasion each time of loud expressions of admiration.

The Antoinette, without doubt, is the most picturesque of all flying machines, and Mr. Latham, who has always remained faithful to this type of machine, is able to demonstrate its beautiful flying in a most perfect way.

It is a notable thing, that soon after he has begun to feel accustomed to flying in the machine, Mr. Latham began to make experiments in a wind. There is little doubt but that he was the first airman to venture aloft in anything like a strong wind. At Chalons, where he conducted his early trials, other pilots who were learning to fly became amazed at the gusty winds in which he did not mind taking out his machine for a flight. It was his contention then, as it is now, that real skill lies in combating a wind.

The sensations of the struggle, when battling with gusts, seems to delight him also.

On one special occasion, of which many people have told me, Latham acquired his nickname of being the "Fighter of the Wind." The incident occurred at Chalons. It was a windy day, gusty, and boisterous. All the machines were in their sheds, and most of the aviators, after waiting in disgust for the wind to drop, had left the ground. Then Latham came out with the idea of flying. He rose against the wind, and climbed fast. The few people who were there have always declared, since, that they saw the most wonderful exhibition of skill that has ever been witnessed. When it had attained a good elevation, the monoplane appeared to be caught by the force of the wind. It practically stood still, and then began to be beaten slowly backwards. The gusts struck it with such violence that it rocked and swayed to an extent that those who saw it say was most alarming.

Although it seemed every moment that it must be overturned, Latham made no attempt to descend. Irresistibly, the monoplane was driven backwards. Although the engine was pushing it forward, at a speed of close upon forty miles an hour, it could make no headway at all. The machine drifted away, helpless in the power of the wind.

But Latham sat busy with his controlling

wheels, quite unmoved by the predicament in which he found himself. After a short time, desirous of returning to his starting point, he made up his mind to get the better of his enemy, the wind. So he made a swift dive towards the ground. To those below, he seemed to be dropping at a tremendous pace; so indeed he was. The impetus that his fall gave him, enabled him to make headway against the wind. And so, at the finish, he landed quite safely not very far from the spot at which he had risen.

As an absolutely daring exhibition of flying, this flight of Latham's will probably remain as something quite historic in the annals of the Chalons aerodrome. Latham's fights with the wind have been described to me by a friend of his, as a never-ending one.

"Latham, and the wind," said the friend, "are sworn enemies. He has determined to get the better of the fight and never loses an opportunity of continuing it. On one or two occasions the wind has got the better of Latham, but on the other hand, he has triumphed over the wind on many memorable occasions."

One of the times when Latham won his fight against the wind, was at the first flying meeting at Blackpool, held in the autumn of 1909. The wind on this occasion was blowing very hard, and was, moreover, blowing in gusts. It was so strong, in fact, that some of the gusts were re-

corded on an anemometer as being at least forty miles an hour.

People had been waiting all day to see some flying. But it was only natural that in the face of such conditions the flyers should prefer to remain on the ground. After lunch, while the crowds were still waiting patiently, Mr. Latham motored up to the ground and declared that he would attempt a flight.

The members of the committee begged him not to think of doing so. It appeared to them far too perilous an undertaking. But Latham was politely firm about the matter. He insisted that the black flag, which indicated that there was no likelihood of flying, should be taken down, and that the red flag, meaning that flying was to begin, should be hoisted in its place.

There was astonishment on the part of the crowd when this signal was raised. Even to people who were not conversant with the technicalities of flying, it appeared foolish for any one to attempt a flight in such a wind. Latham got off the ground safely, and rose to a height of about one hundred feet. His progress down the course against the windy gusts was represented by a series of ten-feet jerks.

As each gust struck the machine, it stood still. Then, when the wind lessened a little, it forged slowly ahead. The pilot displayed absolutely astounding skill in preserving the equilibrium of the machine.

After flying down the course against the wind, he began to turn round one of the pylons. Here, catching the wind sideways he was in imminent peril of being overturned. However, his skill stood him in good stead, and he managed to swing round and move off with the wind.

When he did so, the effect was extraordinary. From proceeding at a snail's pace the monoplane suddenly seemed to leap through the air. It was calculated that, swept forward on the wind, Latham attained a speed of quite eighty-five or ninety miles an hour.

Two perilous circuits of the course he made before descending. When he did come down he was naturally greeted as a popular hero.

Once or twice the wind has had its revenge upon Latham. At the Lyons meeting, for example, a gust caught his machine while he was turning, dashed it to the ground, and wrecked it. His experience of wind flying, like that of others, has convinced him that what is necessary in order to combat adverse winds is greater speed. If he could fly at seventy or eighty miles an hour, instead of the forty-five or fifty that is his best so far, he is sure that he would achieve very much better results. To this end, it is his aim to equip his Antoinette monoplane with greater horse power.

In this section of my book I am going to deal with the constructional features of many ma-

chines, and the methods that have been employed by the famous makers, in their early efforts to build successful aeroplanes.

It is an undoubted fact that the first ideas came to builders from a study of box-kites. Take, for example, the machine on which M. Santos-Dumont made his first epoch-making flights at Bagatelle in France. This machine appeared to the ordinary observer to be a box-kite, pure and simple. It had two big main planes, divided into cells, while right out in the front was another and smaller cell, which acted as an elevator. With this queer-looking machine, M. Santos-Dumont was actually able to fly.

One cannot pass on to other constructional features without paying a tribute to the courage and assiduous work of this pioneer of aviation.

M. Santos-Dumont has worked strenuously to perfect the flying machine. First one found him experimenting with a great number of dirigible balloons. With these he had many miraculous escapes from death. On one occasion, he finished a rather ill-fated flight on a house-top in Paris, where he slid down a wall, and so escaped injury.

One of the characteristics of this Brazilian airman has been his great agility. One could not very well imagine a man better suited for experimental work with flying machines. He is light, extraordinarily active, and with practically no nerves at all.

A Santos-Dumont Demoiselle monoplane

Recently, as readers may know, he has been devoting himself to the perfection of an extraordinarily compact and interesting monoplane, which has been christened the "Demoiselle." This is the smallest machine of its kind ever built. At first glance it seems a very tricky machine to have to fly. In fact, one critic, whom I heard discussing it, said, "It would require an acrobat like Santos-Dumont to do much with this machine."

This criticism, however, is rather disproved by the fact that other pilots, notably M. Audemars, have been able to fly quite well on this machine. As a matter of fact, however, its small size renders it a somewhat difficult machine to manipulate. But to see Santos-Dumont flying upon this machine which has been described as "a pocket-handkerchief in the air," is a revelation of man's dexterity. Without doubt M. Santos Dumont will be heard of still further, in the field of aviation. He is the type of man to succeed.

Now we will turn again to two personalities which stand out, and will always do so, in the annals of flying. I refer to the two famous brothers, Orville and Wilbur Wright. It would be hard to find two more interesting men. First let us take Wilbur. Here you have a man completely engrossed in his work. He is tall, with an impassive face. Nothing can move him from the path he has chosen. He is quite unemotional. He

has learned, by bitter experience, that in the development of flying one must always be ready to meet irritating checks with a calm demeanor.

His brother Orville is equally distinctive. Here you have a smaller man of a rather different type. Orville is a little more demonstrative than his brother Wilbur. He might be said to supply the enthusiasm that Wilbur lacks. It is most interesting to imagine these two brothers working together. Wilbur would be cold, calculating, and quite unmoved. Orville would be more full of life and interest, and ready to supply the eagerness, and what one might call human feeling, that his brother lacks. In setting forth upon the conquest of the air these two brothers commenced an almost superhuman undertaking.

In quite a humble way they began their experiments. They were determined that nothing should turn them from their purpose. They were equally determined that they would show no impatience, however long it might take them to solve the great problem. They also made another heroic resolve. They decided that they would discard all previous theory regarding the construction of an aeroplane. After reading every book that had been written on the subject, and studying all the designs of experimental machines, they began their own work with absolutely open minds.

One of the most useful things these two wonderful brothers decided to do, was to gain experi-

ence of the air by making gliding flights with small types of aeroplanes unequipped with motive power. Gliding, as this form of amusement is now called, is extremely useful to anybody who seeks to become an airman.

The sport is enjoyed in this way. A miniature aeroplane is constructed which will either glide off a rail into the air, or which can be towed forward by men, with the pilot in it, until it has gained sufficient speed to start away on a gliding flight. To carry out gliding experiments properly one requires a hill with a gentle slope on one side of it. Granted this, what one does is to start one's glide from the top of the hill. Released, either from its rail, or by being given impetus by men who hold it, the model aeroplane glides away down the hill side, generally not more than a few feet from the ground, until finally touching ground.

The length of a glide is generally determined by the strength of the wind that is blowing. If a glide is begun against a fairly steady wind it may be possible for the aerial experimenter to continue moving smoothly through the air without any motive power for several hundred feet.

The value of such work can readily be seen. One can, by such inexpensive means, gain a practical knowledge of the way in which the levers of a flying machine must be moved, in order to control it when in flight.

It is much easier to learn to fly in the early stages by means of a glider, than it is to begin right away to pilot a power-driven aeroplane. It would, in fact, be much wiser for beginners to do a course of gliding practice, than to come straight away to a school, and begin at once to experiment with an aeroplane fitted with an engine.

But this is an impatient age. Men want to do things quickly, and after the first problem was solved it would be considered a waste of time for intending pilots to do this "course" of gliding. But several men have profited very greatly by going through a course of gliding. Notably, one can mention the late Hon. C. S. Rolls.

Long before he trusted himself at the levers of a power-driven Wright machine, he had been practising for months, upon a suitable hill, with a gliding apparatus. One may, I think, attribute a great deal of the thoroughness of the Wright brothers' flying to the fact that they went thus into the theory of aeroplaning by their practice with gliders. The machine they evolved was certainly the fruit of their gliding work.

First of all, in fact, they built a model machine with two main-planes, a small double elevator, and a twin rudder behind, and towed it as a kite in order to see what lifting powers it possessed. By such experiments as this, they were able to form their own opinion as to what was the most

efficient curve or "camber" on the planes to obtain a maximum lift. Gradually, in this way, they worked out all their theories, toiling on alone, and with intense concentration. The most extraordinary feature about the pioneer work of these two brothers was their patience. Months and months went by, with only trifling advances being made; their actual opportunities of flying were few, but still they persevered, proceeding in a perfectly logical way.

From kites they gained sufficient experience to embark upon the construction of gliders. Lying prone in these machines at first and afterwards sitting upright to control their levers, these two brothers studied every movement of the gliders while they were in flight.

They saw where the control could be improved, or where the weights could be altered, to give the machine greater stability. The result of this experimental work was that they had a most carefully thought-out machine to hand, by the time they were prepared to fix to it an engine.

Nor was this all. They had, in addition to the machine, an extraordinarily good knowledge of the air. What this may mean only those who have flown know. They installed in their machines a most efficient system of control. With one lever they could make their machine ascend or descend, and with the other they were able, with a dual movement, to turn the machine round,

and also correct any falling movement from side to side.

Their first flights will be ever memorable. The reception of them by the world was typical. Naturally, seeing that for centuries men had striven in vain to fly, nobody would believe that these two men had at last solved the great problem.

Not only was their machine a model of simplicity, but the engine they designed to propel it was equally uncomplicated. An outstanding feature of all the work performed by these wonderful brothers is to me what one may call their respect for the air. Although no men have had a better opportunity to become accustomed to aerial flight, never once have they shown any trace of carelessness.

Familiarity with the air is, I think, one of the most potent factors of danger in connection with flying. Wilbur Wright's great deliberation has always been one of his most striking characteristics.

When he first went to France to give exhibitions of flying, this slow and sure method created, at first, some amusement, and afterwards some irritation. Nothing would induce him to hurry. Nothing would persuade him to make a flight, until he was prepared to do so.

He discarded all arguments and protestations. He knew the air. Those who often asked him to fly did not. Therefore he knew best. Before

making a flight in these early days, Wilbur Wright would go very methodically over every part of his machine. One or two of those people, who were sufficiently favored to see some of his early flights, have told me many interesting stories of their experiences.

Large crowds would assemble outside and around the flying ground. The day, perhaps, was perfect. Presently, with great deliberation Wilbur Wright, who, like a faithful airman, slept beside his machine and took all his meals in the shed with it, would order it to be wheeled forth. There was never any hurry. Very, very slowly, the machine would be brought into the open. To the watching crowds, impatient to see the wonderful spectacle of a man in flight, all these preparations were dreadfully wearisome.

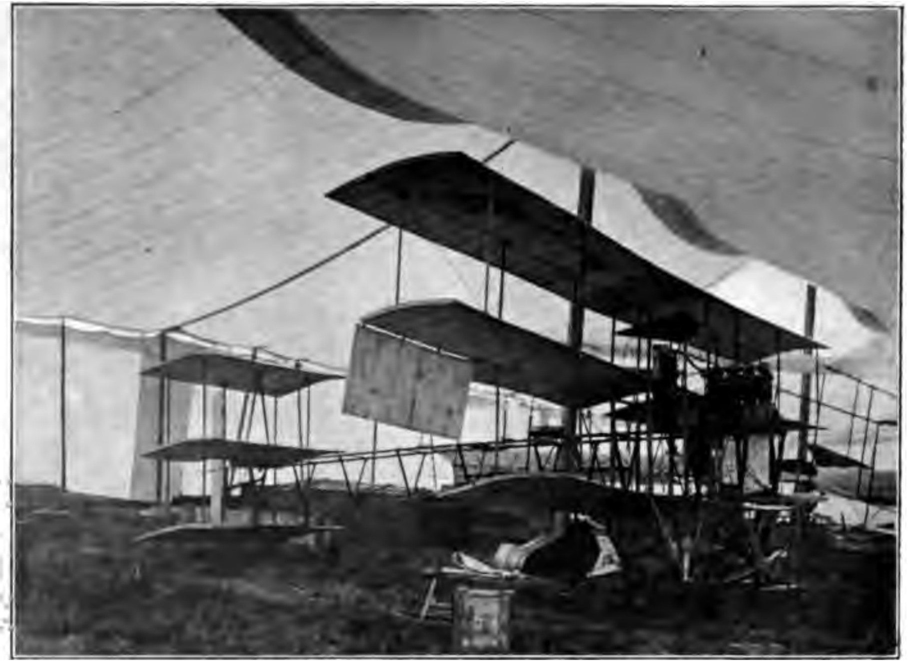
But this did not matter in the least to Wilbur Wright. Whistling in a way which was said to be peculiarly irritating to those on the tiptoe of expectation, the airman would walk negligently round and round his machine for many minutes, touching a wire here and a strut there. Then he would test the control mechanism time after time. After another interval, he would direct the engine to be started. Then, sitting in the pilot's seat, he would listen to the way in which the engine ran for another long period.

Eventually, when the spectators had arrived at a veritable fever of impatience, he would grace-

fully take the air. Naturally there was a very considerable method in this madness. The result of it can be seen to-day. Where death has claimed more than one pilot who began to fly since their day, these two brothers are still alive and well, and capable of a very great and useful work. The moral of their way of going to work is this; they knew from their own experience that no liberties can be taken with the air.

Now let us turn to France. Here we find two pioneers of great purpose. I refer to Voisin brothers. Their first machine, constructed after many months of patient work, was a highly interesting one. It would now be considered both clumsy and slow, but in those early days it was quite a wonderful machine.

It is curious to think that we have already reached, with flying, a stage when we can look back pitifully upon the groping work of the beginners. The characteristic of this first Voisin machine, when looked at in the light of our experience of to-day, was the long run it required before it would rise from the ground. It was such a big and heavy-looking biplane that the people who came to see it declared emphatically that it would never rise from the ground. It was difficult, indeed, for this machine, with its metal parts and heavy engine, to rise into the air and fly. When it mounted, it was a revelation to those who saw the flight.



Mr. A. V. Roe's triplane

When one considers the first flights of the Voisin machine there is introduced upon the stage of aviation a very notable person, in the figure of Mr. Henry Farman. It is interesting to remember what he was, before he became world-famed as an airman. Mr. Farman had been interested in sport from his very early days. He was a notable cycle rider, and took part, with success, in many of the great contests that characterized the boom in cycling. Afterwards, he turned his attention to motor-car driving, and took part in many of the great races, driving high-powered cars with great skill and calmness.

He was, therefore, eminently suited to take up this new sport of flying. And now one's mind is carried, inevitably, to the first scenes at Issy-les-Moulineaux, where the Voisin biplane, piloted by Mr. Henry Farman, made its initial flights. I do not think any one could picture a more dramatic scene than this. Here were the machine, and the man who was to fly it, and a crowd of people watching, who, while they hoped that the aeroplane would fly, were very much afraid that it would not do so.

Then the wonder came. The machine actually flew. The enthusiasm, at even a flight of a few yards, was wonderful. Crowds of people leaned down, in order to be able to see the moment when the wheels of the aeroplane lifted from the ground. Directly they did so, there was a roar of

cheering. Of course these flights, at first, were very brief, and were only carried out at a height of a few feet above the ground. But still they were wonderful enough.

People who saw this first Voisin biplane actually in the air will never forget the sight. What Mr. Henry Farman did at first was to make a series of straight flights along the ground, only a few feet in the air, until he became quite accustomed to the manipulation of the machine. The great difficulty he found was in attempting to make a turn in the air. On many occasions, when he tried to do this, the machine showed a tendency to descend towards the ground. Mr. Farman had to make many attempts before he performed a half-circle. He managed to do so by rising a good deal before he came to make the turn, so that the machine did not touch the ground, when it began to lower itself in the air, as the descending motion was made.

Delagrange is the next famous flyer to whom I will make reference. Delagrange was a sculptor. When flying began to be talked about, in its early days, the enthusiasm of Delagrange was fired. He decided that he must become a flying man. He went to the Brothers Voisin, and made an arrangement with them to try one of their machines.

His first flights with it were extremely good. Afterwards, becoming a great advocate of the speed of aeroplanes, he was induced to try a mon-

oplane. The machine he chose was a Bleriot. His desire to increase the speed of his flight, which he reckoned to be the only method of combating high winds, led him to fit to this monoplane a Gnome motor of 50 horse-power. This power was more than had been previously applied to any monoplane.

With this engine at Doncaster, in the autumn of 1909, Delagrange succeeded in flying at a pace of fifty miles an hour. This created a world's record. Subsequently, taking the same machine to Bordeaux, Delagrange carried out a number of further tests. In making one flight in rather a high wind, he met with a disaster which cost him his life.

What happened exactly no one can say. While flying at a fairly low elevation, the wing of his machine was seen to collapse. The machine was dashed to the ground and Delagrange, one of the great pioneers of aviation, was robbed of his life.

Now let me refer again to the work performed by Henry Farman. Not long after he had achieved his first triumphs upon the Voisin biplane, this hard-working experimenter decided that he would endeavor to construct a machine according to his own ideas. The result was a biplane which was certainly in advance of anything that had been seen before. In comparison with the Voisin machine, which Farman had been

flying, the biplane he built was lighter, had a more efficient chassis, and was fitted with several other improvements, notably "ailerons" or small balancing planes, which were designed to give the machine a better facility for correcting any sideway movement while flying. Altogether, the first Farman biplane was an extremely workmanlike construction. It was particularly interesting also, seeing that it represented the practical idea of a practical flyer. Farman was a pilot before he was a constructor. Therefore his machine had in it many practical ideas which previous models, the work of constructors only, and not flyers, had lacked. His success with this machine was remarkable.

Not only did he himself achieve triumphs upon it, but his fame brought him a great many pupils, who soon became proficient in handling the machine, and added to its reputation by the flights they made upon it. As a matter of fact, Farman presents one of the most interesting personalities in the whole world of flying. His ability as a pilot is scarcely well enough understood. For one thing, he possesses judgment that is almost superhuman, and like the Wright brothers he has patience that can never be flurried.

There are, indeed, few men in the world who possess these rare characteristics to the same extent. It is a fact, too, that when a man of a more impatient temperament takes to flying, he has to

A Farman biplane A Wright biplane A Curtiss biplane

run a far greater risk of accidents. Farman's record, in the way of accidents, is, considering the amount of flying which he has done, extraordinarily good. One peculiarity of this famous airman is that he never flies any higher than he considers necessary. A point to illustrate this occurs to me in connection with the great Rheims meeting of 1909.

Here, in making his record of over three hours in the air, Farman flew extraordinarily low. In fact, he seemed to rise and fall in the air, over every little hill and valley as he sped round the great course. Undoubtedly Farman represents one of the most scientific flyers of the day, and he is even more than a flyer. He is a deep thinker, and his one idea is to improve his machine. He is never content to stand still, and above all he never seems carried away by any wild outbursts of enthusiasm when he has achieved anything particularly noteworthy in the way of a flight.

He is the type of man who is always quietly hopeful and very industrious. What Farman has done for the science of aviation few people realize. One of his most characteristic actions is the way in which he cautions pupils against taking unnecessary risks. He is always keen to prevent men from "taking chances" in regard to flying.

Many stories are quoted, in this respect, of wild and daring pupils who have come to his flying school at Chalons. There was, for instance, the

case of Efimoff, a Russian of remarkable characteristics who came to learn to fly, backed by a syndicate of financiers. Efimoff knew no word of any language save Russian. He was perfectly fearless, and it was his intention to learn to fly as speedily as possible. To the amazement of his instructors, he attempted aerial dives and rapid ascents almost before he had mastered the control of his machine.

Naturally, with a man taking such risks as these, an accident was sure to come. He had one, which might have been very serious, had it not been for his own remarkable presence of mind. In making an ascent one day, he took his machine up in the air at too steep an angle. It stood still, and then fell backwards towards the ground, tail first. At the moment it was at a height of about 100 feet. During the brief descent Efimoff did a most remarkable thing.

He forsook his seat and scrambled to a place of .greater safety, with the result that, although the aeroplane was wrecked, he himself escaped without injury.

Another tale that should be told concerns an English pupil at the Farman school, Mr. Rawlinson. He had fitted to his biplane an engine of unusual power. The first time he climbed into it and set off across the ground, this engine exercised so much power that it literally forced the aeroplane up into the air.

Mr. Walter Brookins in a Wright biplane and Mr. Grahame-White in a Farman biplane. This picture shows the difference in construction between the two machines

Practically, without his own intention, Mr. Rawlinson found himself flying at the very first time of asking. Not only did he find himself in the air, but he also found a considerable difficulty in getting back to earth again. His machine actually flew a distance of three kilometers before he was able to get it back on to the ground. This was certainly a remarkable flight for a beginner, but in those early days of the Farman school many strange things were accomplished. There was a little hotel at Chalons, where the aviators who were learning to fly stayed, and here, too, Farman, their instructor, used to live and give them words of wisdom when they met at meals. There was a most curious fascination about this rough and simple life.

The Voisin brothers, after their early efforts in the construction of machine, made steady progress. They soon attempted to improve upon their first flyer. The result was a biplane which was both faster and lighter. These famous brothers are still experimenting.

CHAPTER III

THE FIRST HISTORIC FLIGHT FROM FRANCE TO ENGLAND

One of the most interesting aspects of flying, to the ordinary reader, is the story of the memorable performances that have been achieved by the world's flyers. I have carefully collected a good many of these narratives, generally obtained in conversation with the flyers themselves, or from people who have seen the feats recorded. In this section of my book I propose to deal with some of the most remarkable adventures which have befallen the pilots of aeroplanes. The first will be M. Louis Bleriot's memorable flight across the English Channel on a summer's morning in 1909.

M. Bleriot came to Calais directly after he had heard that M. Latham, in attempting the cross-channel flight, had fallen into the sea. At this time, M. Bleriot, after a good deal of trouble with aeroplane engines, had found one, a three-cylinder Anzani motor, which had begun to operate very well. Upon this machine, a day or so before he came to the coast, M. Bleriot had performed several remarkable cross-country flights.

His aeroplane was an extremely interesting one. It was a monoplane which he had evolved after several years of the most painstaking experiments. The result of the building of a number of machines had led him at last to produce one of an extreme simplicity.

It had two planes, fitted upon either side of a tapering body, like those of a bird. In the bow of the machine was the motor, actuating a two-bladed propeller of the tractor kind. The pilot sat in the body of the machine, between the planes, and towards the rear edges of them.

Behind him, at the extremity of the tail, were two planes to act as elevators, and the rudder. The control of the machine in flight was exceedingly simple. One lever, working on a universal joint, operated through wires the warping of the wings which gave the machine lateral stability, and also the two planes at the tail which caused the monoplane to rise into the air.

For the control of the rudder a cross-bar was set near the pilot's feet, and this he operated by moving it to and fro.

M. Bleriot left his machine at the railway station at Calais while he sought for a suitable spot to house it preparatory to making his flight. He chose a shed near an open stretch of grass land close to the sea at the little village of Les Baraques, not more than a couple of miles from Calais.

Latham, his rival, who had been at Calais for some weeks previously, had housed his machine in a tent on the side of Blanc Nez, some distance farther from Calais, and near an old ruined power-house which had been used in connection with the project to bore a tunnel between England and France.

M. Bleriot's preparations for the flight were very simple. He arranged for a torpedo-destroyer to follow him across the water, had his machine erected and tested, and then waited for favorable weather. In those days flying in winds was practically unknown. It was reckoned that the Channel could only be crossed in practically a dead calm. Latham had been waiting wearily for his first chance. When the wind was not too high it was found that there was fog. Rain squalls and sudden gusts also came to prevent flights. The channel weather indeed proved a curious study. By means of wireless telegraphy, the cliff at Sangatte and the Lord Warden Hotel at Dover were in constant communication. It was more than once discovered that when the sun was shining at Dover there was a rain storm at Calais, and vice versa. The real trouble, as regards these early attempts to fly the channel, was the fact that a wind would spring up in only a few minutes.

In Hubert Latham's first attempt, made early on quite a perfect morning, the electrical equip-

ment of his engine gave trouble, and he had to descend in the water after flying only about 12 miles. Then we come to Bleriot's remarkable flight, performed soon after dawn on July 25, 1909. There had been a curious meeting between the rival airmen on the previous evening. With the captains of the torpedo-boats which were to follow them across channel, they came together at the Terminus Hotel, and enjoyed a friendly chat for some time.

One of the questions debated was whether the next day — Sunday — should be regarded as a blank, and no flying undertaken upon it. Latham was quite willing to regard Sunday as an off-day. But Bleriot, who seemed particularly anxious to make his attempt as soon as possible, said that he should fly the next day if the weather was fine. He was probably influenced in making this decision by reports which were brought to him indicating that the next morning would very likely be clear and fine.

After the airmen had separated, M. Bleriot went to bed at the Terminus Hotel with instructions that he should be called at 2.30 A. M. This was done, and the weather then was found to be absolutely calm. Whereupon, M. Bleriot decided that he would start upon his flight at sunrise — which was at about half past four.

The extraordinary courage of this remarkable pilot was well evidenced after he had made his

decision to fly. He ate a hearty breakfast, and then motored to Les Baraques. He was quite cheerful and confident of his success. The most remarkable feature of this enterprise was the fact that, at the time he undertook the cross-channel flight, he was a cripple. A week or so before, while carrying out some tests with his monoplane, he had severely burnt his foot. Thus on the morning that he flew the channel he was still unable to put foot to the ground.

Therefore, the few spectators who saw the start of this memorable flight witnessed the curious spectacle of the airman hobbling on his crutches to the side of his machine, throwing them aside, and clambering stiffly into his driving seat.

When Bleriot and his little party arrived at Les Baraques there was some time to wait before a start could be made for the flight, seeing that the rules laid it down that there must be no commencement until sunrise. M. Bleriot instructed his mechanics to bring the monoplane from its shed. He then said that he would make a trial flight. It was an amazing thing to those watching him, to see the ease with which this expert pilot maneuvered his small craft.

It rose in the air after a very short run along the ground. M. Bleriot flew out towards the sea, made a half circle, and returned to his starting point, announcing that the machine was in perfect flying order. Then there came a wait.

At the hour of sunrise exactly, the airman waved aside the men holding his machine and passed off over the sand hills towards the sea, which was now enshrouded by rather a thick mist.

Another factor against the airman, also, was a rising breeze. When he had first come to the shed, Bleriot had found it almost calm. But, while he had been waiting, a faint breeze had freshened to a little wind, and those who watched the sea saw small " white-horses " forming upon it through the power of the wind near its surface.

This rising of the wind was pointed out to M. Bleriot. He made little of it, however. His view, very clearly expressed, was that opportunities of crossing the channel was so rare that any reasonably good chance should not be missed.

Bleriot crossed over the sand-hills, and passed out to sea at an elevation of about 200 feet. Lying some miles off shore was the French torpedo boat destroyer *Escopette*.

By a pre-arranged signal she was informed of the airman's start. Directly this news came she turned, and steamed as fast as possible towards Dover, so as not only to rescue the airman, should he fall into the water, but also to act as a guide for him in steering his course.

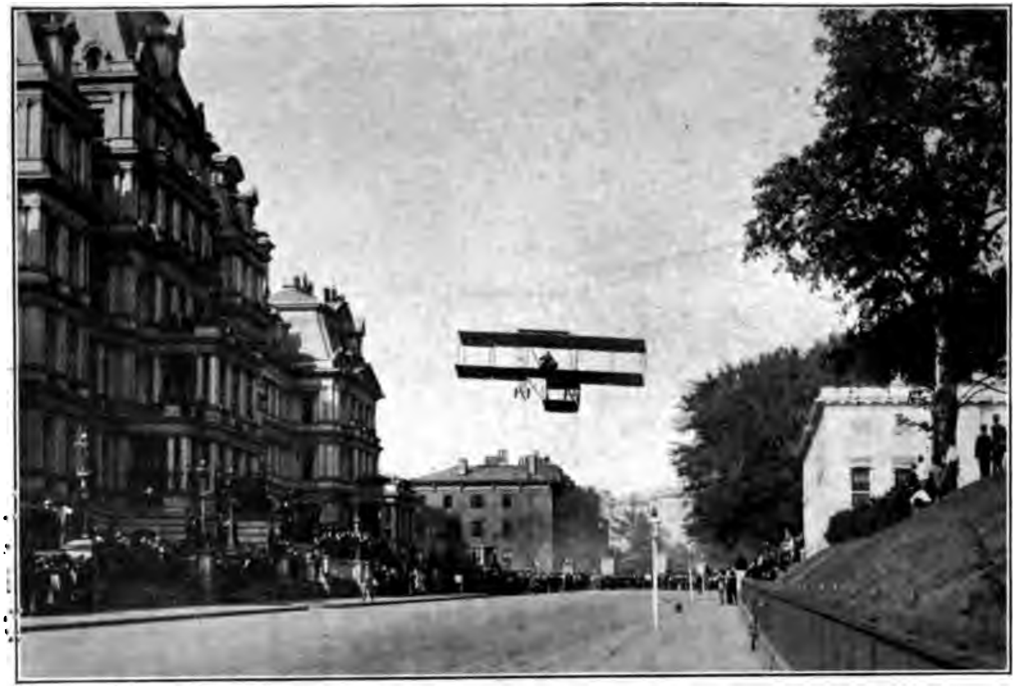
But, although the *Escopette* was a very fast boat, the extraordinary rapid progress of the air-

man made her appear to be moving very slowly. When only a few miles on his way, M. Bleriot found himself flying directly over the decks of the destroyer. It had been arranged, in his chat with the captain, that if he found himself flying too fast, the airman should circle round in order not to lose sight of the destroyer.

But it is clear that M. Bleriot, once he found himself over the channel, and committed to his perilous journey, did not feel inclined to wait about. At any rate, he forged ahead, and although the *Escopette* steamed on at her utmost pace, those on board her had completely lost sight of the monoplane before mid-channel was reached.

With the torpedo-destroyer out of sight behind him, and with no vessels appearing on the surface of the water ahead, this courageous man flew on. Exactly what his bravery meant it is well to remember. Fitted to his monoplane, before he had started upon the flight, was a long air-bag. This was intended to keep the monoplane afloat should it fall into the water. But the efficacy of the air-bag was doubtful. Experts generally agreed, in fact, that the machine would not, had it fallen into the sea, kept afloat for more than a few minutes.

The pilot himself, had he found himself in the water, would have been in a hopeless condition, seeing that his bad foot made him temporarily a



Mr. Grahame-White, in his Farman biplane, starting from Executive Avenue, Washington, D. C., on his return flight to Bennings, October 14, 1910

cripple. And, early on this summer morning, there was remarkably little shipping in the channel.

Therefore, in this endeavor of his to win the *Daily Mail* £1,000 prize, M. Bleriot, beyond all question, took his life into his hands. He had started the flight with some distant and misty view of the English shore, but, soon after he had left the torpedo-destroyer behind, the sea fog into which he went, as he passed across the water, robbed him of all sight of his destination.

The position of this lonely airman can be imagined. Bitterly cold, and with a fierce rush of wind in his eyes, he found himself flying over the water with absolutely nothing to guide him, and with no friendly ship or sail in sight. He felt none of the confidence in his motor that is experienced by present-day airmen.

All his previous experiments had shown him that engines were not to be relied upon. To get one to keep turning for half an hour was, at the time Bleriot made his flight, quite a notable achievement. The pilot knew, in this connection, that a flight of at least half an hour, and probably more, would be necessary before he passed over dry land again. His thoughts can, therefore, be better imgained than described.

To his credit, as one of the most daring pilots in the world, it may be said that he kept on unflinchingly. For one terrible period of ten min-

utes, M. Bleriot was completely lost in the sea mist. Neither he, nor those to whom he has told the story of this ten minutes of suspense, are likely to forget the incident.

He had in his mind a definite idea of the direction in which Dover lay, and he did his best to keep to that course, although he had no means of telling what leeway he was making. As he flew on, his attention was entirely taken up by the manipulation of his machine. His ear was constantly turned, also, to detect whether there was any suggestion of flag or fail on the part of his motor.

Fortunately for M. Bleriot his engine did not give trouble once during the course of the flight. Maintaining his altitude very well, but much baffled by the growing strength of the wind, the airman flew on through the mist. When he emerged, eventually, on the other side of it, he was delighted to see the vague shape of cliffs some considerable distance ahead of him. After some half hour's flying he was near enough to the shore to make a brief survey of the land ahead. He then discovered that he must have made an error in direction whilst flying across channel. It was not Dover, with its conspicuous castle, which lay before him, but a desolate stretch of cliffs. Quite correctly, having in view the direction of the wind, M. Bleriot divined that he had been carried too much to the north-east, and was

approaching the coast at a distance of some miles above Dover.

Waiting until he had got fairly close to the cliffs, the pilot turned, and flew back towards Dover. It was at this point that the supreme struggle of the flight began. As he had been flying across channel the wind had been steadily rising. Now it blew with some violence.

Gusts swept out from the land, and made the airman's craft rock perilously. But M. Bleriot, always a determined man, had more determination than ever now. With every faculty engrossed with his fight against the wind, he flew on.

In a minute or so Dover came in sight. The question now arose as to where he should make his landing. He was not flying, at the end of his adventurous journey, so high as he had been in mid-channel. The wind had been gradually beating him down, so, as he neared his goal, he decided that it would be unwise, in view of his reduced height, to attempt a landing where he had originally intended — on the Shakespeare Cliff.

Instead, he steered quickly in through a break in the cliffs, and actually came to rest not far from Dover Castle. His descent was the most risky part of the whole undertaking. As he came close to the cliff, one treacherous wind gust after another assailed him. The few people who were privileged to see the arrival of the aeroplane on

English soil were terrified when they observed its violent movements as it was caught by the wind gusts.

Choosing a smooth piece of grass for his descending point M. Bleriot came planing down. As he did so, however, three or four especially violent gusts of wind caught his machine. It was actually spun round three times, like a top, before it touched earth. Then, making a bad landing, as might have been supposed, the airman damaged the under carriage of his machine, and broke the propeller.

As the machine — the first visitor of this kind to English shores — landed upon this quiet Sunday morning, the airman climbed stiffly from his seat. One curious thing was noticed by those who first reached the spot. Despite the fact that it was an exceedingly cold morning, and everybody was glad of an overcoat, M. Bleriot — who wore nothing but a pair of overalls over his ordinary clothes — was seen to be bathed in perspiration.

This, in itself, was a sufficient indication of the strain through which he had passed. It had been a wonderful feat, performed with extraordinary daring. Such a flight may not seem much to us in these days, when the Channel has been crossed seven times.

In fact, very little significance attaches now to the crossing of this piece of water. So reliable

have aeroplane engines become that the feat can now be undertaken with comparatively little risk.

But M. Bleriot was a pioneer. He braved unknown dangers. Dreadful vertical currents of air were supposed to be lurking in mid-channel. It was also unlikely, and he knew it, that his engine would run without breaking down during the crossing of the Channel.

CHAPTER IV

THE FIRST OF THE FLYING SCHOOLS

Before the cross-channel flight biplanes — as representing the best type of aircraft — had had it almost entirely their own way. The monoplane was regarded as being a highly dangerous and very experimental machine. Those who, like Bleriot, devoted themselves to it were looked upon as cranks. But the flight from France to England altered all this. From being an experimenter, with no demand for his output, M. Bleriot found himself compelled to build monoplanes as quickly as possible in order to meet the demand that arose.

He quickly enlarged his works in Paris. He gave large orders for Anzani motors. He speedily found it necessary to open a flying school at Pau. Here, anxious to learn to handle this wonderfully compact little machine, came pupils from all over the world.

It was, indeed, remarkable what an impetus was given to aviation by this flight. It seemed as though, for the first time, the world had re-

alized that the aeroplane might become something more than a scientific toy.

Longer flights had been made before. Indeed, before he came to Calais for the flight, Bleriot himself had made a magnificent cross-country flight on his monoplane. But all previous feats faded into insignificance when compared with this remarkable performance of crossing the channel.

From the obscurity of being a little-known machine, the Bleriot monoplane, with its smallness and simplicity, became the universal wonder. At Pau, when Bleriot's school began to get into full swing, curious scenes were witnessed. On fine days, it was no uncommon thing for ten or fifteen beginners to be out with their machines at the same time. Naturally, seeing that learning to fly is a very tricky business, there were many accidents. More than one of the pupils damaged his machine when first taking it out by attempting to make too sharp a turn, when running about the ground, with the result that the monoplane turned over sideways, and broke its wing.

It was surprising, however, that very few serious accidents were recorded during these first attempts of pupils to learn to fly. The chief point of safety lay in the fact that a monoplane, such as they were using, could fall very heavily, and damage itself severely, without in any way injuring the pilot.

On more than one occasion, being too eager to make progress, a beginner fell with his machine, not from any considerable height, but with sufficient momentum to wreck it utterly. Persons who have not realized how the shock of a fall was absorbed by the breaking of various parts of the machine, imagine that the pilot must be either killed or seriously injured.

To their surprise, however, he emerged from the wreckage quite unhurt. The explanation of this immunity from accident can be made quite clear. When a monoplane dives suddenly to earth, at a dangerous angle, the wheels first strike the ground and probably break. Then the lower framework of the under-carriage takes the shock, and usually some of its members break. Afterwards, the propeller catches the ground and breaks.

Even then there is a great deal of stout woodwork to be fractured before the body of the machine, in which the pilot sits, can be reached. Thus it is that long before the airman is in danger of coming into contact with the ground most of the shock of the fall has been exhausted.

Some very queer scenes were witnessed at the Pau aviation school. The idiosyncrasies of the various pupils were amusingly displayed. I had a good opportunity of seeing what was done here, in the early stages of flying schools, seeing that I had myself started a school for British aviators at this place.

What many of the pupils failed to realize was the absolute urgency of becoming thoroughly acquainted with the mechanism of their machine before attempting any flight, however short. When the instructor laid this rule before them, they appeared to understand it perfectly, but immediately they were in the machine and "rolling" about on the aerodrome quite a number of them appeared to throw caution to the wind.

Generally, the antics of a beginner who sought to fly before he was ready to do so were as follows: After tearing about the ground at a great speed he would suddenly move the tail planes so as to lift the machine into the air.

This operation requires to be very delicately accomplished. If too much violence is used, the machine leaps up into the air in an alarming way. Instead, however, of elevating very gently, more than one of these ardent beginners pulled over the lever with a sudden and excited wrench.

The result was extremely startling to them. Instead of soaring up a foot or two into the air, as they imagined they would do, they suddenly felt the monoplane bound up into the air. Before they knew what had happened they were at a height of twenty or thirty feet. This, naturally, had a very disconcerting effect upon a man who had never been off the ground before in an aeroplane.

What might have been expected then hap-

pened. The pilot made a reverse movement just as rapidly as he had ascended. The result was that the monoplane suddenly dived forward, and became an utter wreck in a moment. It was quaint to see the astonished pilot emerge from the ruins of his machine.

He looked very perplexed as a rule, and was very penitent for having infringed one of the most important rules of the school. Another fruitful source of accident was the stoppage of his engine by a nervous beginner when making a flight. When seeing himself approaching a bad piece of ground, or in danger of colliding with some other machine, more than one pupil who had advanced to the stage of flying moderately well quite close to the ground, completely lost his head.

Instead of turning, or rising a little higher, as the case might be, he switched off his engine in a panic. The result was, in many cases, that the aeroplane fell to the ground like a stone, generally ruining its landing chassis.

It was no unusual thing, in these early days of learning to fly, to see five machines wrecked during an afternoon's work; yet in very few cases were the pupils hurt in any way. Apart from this ability to have an accident without personal injuries, the pupils at the school found that it was, generally speaking, extremely easy to learn to fly.

CHAPTER V

THE DEVELOPMENT OF THE AEROPLANE ENGINE

Throughout anything one reads in connection with flying a question is continually arising — it is the question of the aeroplane engine. Without a suitable propulsive agent we could not have reached the stage in flying that we have done to-day. One sees how it was the efficiency of the engine that at last made possible the Channel flight. When one reads the work that was done years ago by aeroplane pioneers, one sees that their difficulty in every case was not in the inventing of planes or in the putting into practical form of theories regarding the control of planes, but in the one problem of what power should be used to thrust them through the air.

I spent a very interesting hour or two not long ago in reading of these early efforts to construct aeroplanes, and also in seeing models and designs illustrating the ideas of these first pioneers.

It is an amazing thing to us, looking at things from the point of view of the present day, to note how very nearly accurate were the theories of men studying flight long years ago. One ma-

chine I remember was built in the form of a monoplane. It bore a striking resemblance to some of our present-day machines. In fact it went a step further than do some of the types we are flying with now.

Instead of being drawn through the air by a single tractor propeller situated at its bow, this machine was thrust forward by two propellers working at the rear edges of its planes. The other day, when seeing the latest idea in monoplanes as constructed by a well-known maker, I was confronted with this idea. Instead of drawing his machine through the air, this up-to-date maker, with all the experience of previous models at his back, decided that it would be very interesting and instructive to see whether a monoplane would not fly better with two screws propelling it instead of one screw drawing it.

Here, in one concrete example, I saw the latter day inventor going back upon the theory which had been evolved by a man in the days when no machine had flown.

All that those very early flyers lacked was their engine. If the petrol engine had been perfected long years ago there is no doubt that the world would have enjoyed airmanship long before it did. It is pathetic almost to read how attempts were made to fly with such a power as steam. In one famous instance, after spending years perfecting a piece of mechanism, one inventor succeeded

in producing a steam engine which gave 1 horse-power of energy for every ten pounds of dead weight.

This was regarded as being an extraordinary achievement. It is on record, in fact, that an aeroplane equipped with this particular engine was actually able to raise itself from the ground. But the engine so employed was of a construction which prevented its running for any length of time. Therefore, even with an engine which had its weight so cut down, no very definite tests were possible.

It is instructive to contrast the weight of this steam engine with the weight of some of the petrol engines which we are using for flying to-day. In one of the most remarkable instances of weight reduction we find that an engine develops 1 horse-power for every 3½ lbs. in weight. The difference between this and the steam engine is indeed striking. It means, as a matter of fact, all the difference between flying and not flying. This, however, is judged from the present day aspect of flying, when every pound of weight is of great consideration to us.

In the future, I have a strong idea, this question of lightness will not play so great a part. Already one can detect that there is a tendency towards greater weight. It has been found that machines can be strengthened here and there, and that engines can be made a little more

solid without any adverse effect upon the flying qualities of the machine.

Of course, so far as an engine is concerned, any increase in weight is advantageous to it. The petrol engine has achieved an extraordinary triumph in being applied so successfully to the flying machine. It would be difficult, even if one tried to do so, to find conditions more unfavorable than those which are imposed upon the petrol engine when it is driving an aeroplane.

On a motor car to-day the engine has, when one comes to consider, a fairly easy time. It runs fast and under a heavy load when it is starting a run and it is operating on its lowest speed. But soon after it has started its gears are changed, and it runs comfortably and in peace until a hill is reached. Then, perhaps, it may be put to a test for a few minutes.

Afterwards it has a long "easy" as the car runs down a slope, varied by some more work of a perfectly comfortable character as it goes on again along the level. Thus on a long run, one can see that the motor car engine is not working at its maximum very often, and when it does so, only for a few minutes at a time. If one took one of the best-known engines of the day, and ran it for a long period up hill at its first speed, it would no doubt, despite very efficient water cooling, develop signs of being very hot indeed.

This explanation is necessary in order that one

may realize what problems the aeroplane engine maker was faced with. In order to maintain a flying-machine in the air there is practically, at the present time, no margin of power. One has to keep one's engine, in the majority of cases, running at almost its full number of revolutions in order to maintain the altitude that is required, and at the same time to keep one's machine flying at its proper speed.

There is no question of changing gears. It is a fact, however, that more than one maker, encouraged by the improvements in engine construction, and also by the fact that propellers are improving, is beginning to hope that one may be able in time to give one's engine a little rest while in the air.

But as things stand at present the engine in an aeroplane, from the moment it leaves the ground until it descends again, is working at a very high pressure. Thus, in the early days of flying, the pioneers had a very uncomfortable time. Engines were made very much on motor-car lines. They were lightened, it is true, as much as possible. In many cases they were lightened far too much. It is interesting now, in view of the progress we have made, to look back upon the irritations and annoyances which men went through with the early aeroplane engines.

It was then a question of spending days in

one's shed, striving to tune up an engine so that it would give you, before developing defects again, at least a five-minute flight. The margin between flying and not flying was very much less than it is now. A few revolutions of the engine more or less often made all the difference between getting off the ground or running about furiously upon it. The patience that was displayed in humoring these early type engines was remarkable.

All sorts of troubles were developed by them. One of the very worst features was the liability to overheat after a few minutes' running, and thus lose the power they were expected to develop. In the case of motor-cars, where the margin of power is great, any little loss from overheating is not so important a matter. But in the case of these early type aeroplane engines the slightest failing or flagging, through getting too hot, meant that the pilot had to descend. Unless his engine was developing its maximum of power, he was unable to remain aloft.

This fact was quickly realized by the makers, who did all in their power to remedy the defect. But it was not only a case of overheating with these first-flight engines. They suffered sad trouble in connection with their lubrication. The problem of lubricating efficiently an aeroplane engine was found to be a far more delicate one than that of oiling an engine for a

motor-car. As a matter of fact, many engines, thoroughly good in other respects, were kept back for a long time on account of not having a thoroughly reliable system of lubrication.

And this, even, did not finish the list of things that might go wrong. Bearings on engines for flying machines had to be cut much more fine in regard to weight than was the case with those for motor-cars. The result was that in many instances these bearings failed to do their work. It was not surprising that they should do so. There was no previous experience to go upon; all the makers knew was that an engine of a certain lightness had to be produced, and that this lightness must be achieved somehow. So they lightened here and lightened there, hoping for the best.

It was not until one bearing after another went wrong that they discovered that the strain was greater in some places than in others. It is interesting, in considering these matters, to see how engines improved when flying became fairly common. In fact, all that the makers wanted was experience. As soon as their engines had driven flying machines through the air for fairly long periods, and pilots were able to give them useful data to go upon, they were not slow in remedying the defects they thus discovered.

The great effort that was made in the early days was to obtain an engine for flying that

should be air-cooled, and not water-cooled. The reason why this type of engine was so diligently sought was that it could be made very much more light than was the case with a water-cooled engine. The water-cooled engine, as motorists know, is extraordinarily efficient. But you have to consider that every pound is important when you are building an engine for an aeroplane. So it can be seen that the extra weight involved by water-cooling is a disadvantage. It is a disadvantage, at least, if there is any possibility of doing without it.

With the radiator, water-jackets, pumps, and pipes that go to the water-cooling system of a petrol engine, there is an appalling weight, when one has got it into one's mind that an air-cooled engine may do the work as well. But the early type air-cooled engines were not an unqualified success. The work they were called upon to do was, in fact, so exacting that the engines became overheated after quite short flights, and their power faded away. This meant, of course, a compulsory descent.

In spite of a good deal of failure there were many people who would not give up the idea that a good air-cooled engine could be devised. Amongst these were the makers of an altogether remarkable engine, known as the Gnome. When one comes to consider the development of flying, one is immediately brought

to a consideration of this particular engine. The people who designed this machine had it in their minds that the ordinary practice as regards engine construction must be thrown on one side if a successful engine were to be made for flying machines.

They put out of their minds altogether any idea of what had been done before. They were looking out for something new. They wanted something that would be an engine particularly suited to the new conditions imposed by mechanical flight.

This engine they found. When first it was shown to pilots of aeroplanes, its reception was not altogether enthusiastic. It looked a freak engine. It did not seem possible that it could run for any length of time without stopping. The system of serving it with its petrol, and the method of construction internally, seemed to prohibit anything in the nature of reliability. But the people who launched these criticisms against it did not understand the extraordinary care of design and the rare type of workmanship which had been lavished upon this wonderful engine.

In discussing it, it may be sufficient for me to say — in order that the non-technical reader may understand me — that the engine was so built that the seven cylinders with which it was equipped revolved round their crank shaft, in-

stead of the cylinders being stationary and revolving the crank shaft, as is the case with all ordinary petrol engine practice.

The internal complications brought about by sending these seven cylinders round the crank shaft were, to the engineers who saw them, weird and wonderful. The petrol which fed the engine could only be introduced into the cylinders by passing it through the piston heads. This, in itself, seemed to critics to be an altogether wild idea. There were other questions too, affecting the lubrication of the engine, which seemed almost to prohibit its regular use.

But practical demonstrations soon proved critics to be wrong. At the first Rheims meeting, when the majority of people interested in flying were able to see this remarkable star-shaped engine for the first time, it managed to create, practically at the first time of asking, the world's record for duration of flight.

Mr. Henry Farman, one of the pioneers of aviation, who has always been ready to recognize the value of a new idea, had this engine fitted to a Farman biplane, and set out one evening to lower the record for time in the air. To the astonishment of those who knew what a revolutionary type of engine he was using, M. Farman reeled off lap after lap of the great course until he had remained aloft for three hours and four minutes.

Then all that compelled him to descend was the gathering darkness, which prevented the officials at the various pylons from being able to declare that he had remained in the air during each of his circuits.

Naturally, after this, the Gnome engine began to attract a great deal of attention. M. Farman, more convinced than ever that this type of engine was necessary for flying work, immediately gave large orders for such equipment, and turned out his biplanes as a standard pattern with Gnome engines installed. He was never sorry that he had done so.

Once they were able to have an engine that would run reliably, pilots of Farman biplanes were able to perform many altogether remarkable feats — feats, that is to say, which were remarkable in those early days of flying. It was not, indeed, until one had such a combination as the Farman biplane fitted with the Gnome motor that one was able to contemplate such a feat as the two-hundred-mile odd flight from London to Manchester.

And yet, when the proper motive power was to hand, this flight was made without any great danger, and almost at the first time of asking. The success of the Gnome motor as applied to the aeroplane has, indeed, been extraordinary. Its effect upon the industry is very hard to describe, for the reason that it is so far-reaching and important.

Although at the first Rheims meeting, when the Gnome was introduced, M. Bleriot was fitting his monoplanes with engines having fixed cylinders, he soon saw the necessity of adopting the Gnome. The result was a famous combination, which is known as the Gnome-Bleriot.

With this machine, remarkably fast and having a wonderful capacity for ascending quickly to great altitudes, daring pilots have carried off the majority of the prizes at recent aviation meetings.

The Gnome has been fitted to practically every type of aeroplane, and it has worked with a uniformity which has been wonderful. Already encouraged by the reliability of their Gnome engines, pilots are becoming quite surprised and annoyed when any mechanical defect mars a flight.

In one step forward, by the adoption of this system of revolving cylinders, the makers of the Gnome have dealt a death blow to the difficulty of keeping an engine cool. With its cylinders moving through the air at a speed of some 1000 revolutions a minute, the Gnome will run on for hour after hour without betraying any symptom of becoming overheated. As regards its oiling it will perform its work with quiet reliability. In this regard, though, the engine is found to need a far greater quantity of oil than is the case

Mr. Grahame-White about to "tune up" the Gnome engine on his Bleriot monoplane, at the Harvard-Boston Aviation Meet, Atlantic, Massachusetts, September, 1910

with any fixed cylinder engine. Extravagance, in this regard, is no doubt one of its bad features.

But, up to the present, the use of rather a surprising quantity of oil has been the price that flyers have been only too willing to pay in order to obtain reliability.

In the future, of course, when flying is regarded from a more commercial and not so much a spectacular aspect, the engine chosen will no doubt be the one which is most economical. Then, no doubt, as is the case with motor cars, nearly every engine of a flying-machine will present an equal reliability. It will become merely a question of which is the best method of construction for standing wear and tear, and also which engine runs for a certain distance, using in that distance the minimum of petrol and oil.

In its consumption of petrol, also, the Gnome is rather more extravagant than fixed cylinder engines. But, as I have said before, its wonderful popularity comes from its ability to run on while driving an aeroplane without developing any defects.

The secret of its success lies in the fact that it is a special creation, specially evolved for a special work. Such an engine was needed, and needed very badly, by aeroplane makers. Its lightness, which is, by the way, a point I should have alluded to before, is enormously in its favor.

Being air-cooled and having, in the main, a system of construction which is remarkably simple, it presents a weight which cannot be approached in the ordinary way by a fixed cylinder engine. Another point in its favor is what one might call one of its fundamental advantages.

Its method of adjustment to an aeroplane permits it to run without the vibration that sometimes is found to affect the fixed-cylinder engine. This, in itself, is an important point.

The reader should not gather, from this eulogy of the Gnome, that there is no fixed cylinder engine that has done good work. The opposite is the case. Working very efficiently and very well, the designers of the Renault engine have overcome difficulties until they have produced a machine which, in one instance at least, enabled its owner to achieve a world's record for duration in the air.

But, save in the case of the new type of two-stroke engine which is now being experimented with, the fixed cylinder engine generally implies a greater weight than is the case with the Gnome.

In the majority of cases the fixed-cylinder engine still relies upon a water-circulation system to keep it cool. This makes it have a greater weight than does any air-cooled system.

But here again one must only speak in gen-

A near view of the Gnome motor

eralities. One very successful fixed-cylinder engine has lately been evolved which will work quite reliably for long periods in the air, simply by the adoption of an entirely special system of air-cooling.

CHAPTER VI

MY OWN EXPERIENCES IN LEARNING TO FLY

If one is to tell of one's own experiences in learning to fly one must, perforce, I fear, make one's narrative more personal than one would wish; but my experience as a learner is not unlike that of others, and I simply give it in the hope that it may tell the reader something of what he may be glad to know about the problem that actually confronts any one who would get into the air in an aeroplane.

I must candidly admit, that I believe my first enthusiasm in flying machines was aroused at a very early age by reading cheap, trashy literature, known in my early schooldays as "Penny Dreadfuls," though in reality they were "Half-penny Shockers"; but nevertheless, it was fiction of such an attractive nature that the reading gave me food for thought, and I don't think I shall ever forget the thrills I experienced at about ten years of age when I secretly purchased and read "Deadwood Dick's Electric Coach" and "The Voyage of the Flying Dutchman."

I subsequently read several of the novels of Jules Verne, with whose marvelous foresight and ingenuity the reader is no doubt fully acquainted, and whose books on submarines and airships he will readily remember.

However, more serious studies were before me, and for several years general mechanical and electrical engineering attracted my attention, and it was not until three or four years ago that I renewed my interest in aeronautics.

I then purchased a balloon of about 40,000 cubic feet capacity, made several ascents from the Battersea Gas Works in London, and accomplished several long journeys in the air with friends as passengers.

This form of aerial travel, however, soon palled on me, for it was impossible to go where I wished; one was compelled to go in the direction in which the wind carried one, and this sort of thing made one feel very much at the mercy of the elements. So as there appeared no satisfactory and inexpensive manner by which one could control the balloon, I soon lost all interest, sold the balloon, and decided to turn my attention to the heavier than air machine.

Here, as can well be imagined, I was confronted with many problems which appeared to me insoluble. Nevertheless, I started making models, and became so absorbed in the difficulties encountered and so fascinated that I grossly

neglected my other business calls and duties and devoted my whole time to my models.

At this time my pet theory was centered in the "helicopter," a form of aeroplane with vertical propellers which I fondly hoped would obviate the necessity of the long run along the ground to rise into the air, which was at that time necessary.

Just as I was perfecting one of these models, the whole world was electrified by the wonderful flights accomplished by Wilbur Wright in France, and subsequently, by the marvelous flight made by Louis Bleriot across the English Channel on a new type of monoplane, a form of machine which appealed to me at that time as the nearest approach to the acme of perfection.

I soon learnt that the first aviation meeting in the world was to be held at Rheims in France in August, 1909, and I immediately decided to go over, view all the various machines, and, if possible, purchase the best machine and learn to fly it at the earliest possible date. When I reached Rheims, however, I discovered that although I was a founder member of both the Royal Aero Club of Great Britain and the French Aero Club, under whose auspices the meeting was being held, and to whom I applied for a pass on to the ground to view the machines, I was stoutly refused this privilege; so the first day I had to content myself with a view of the machines from a long distance, penned

Mr. Grahame-White making a start in his Bleriot monoplane, showing the method of getting away. The engine — in this case on the front of the machine — is started, mechanicians hold the aeroplane back; when the aviator, having decided that everything is running smoothly, signals with his hand the machine is released

up in the grand stand and the various inclosures far away from the aeroplane sheds. On the second day this kind of thing was fairly exasperating me, so I tried to assume an air of great importance, walked straight up to the attendants, who were vigorously guarding the entrance into the aerodrome, and in my best French asked in which shed I should find Monsieur le President, who had just arrived from Paris and was inspecting the various machines, in company with General French and his staff, who were representing the British army at the French army maneuvers. I was immediately courteously answered with the desired information and in I walked, and, with a little diplomatic maneuvering, managed to gain access to the sheds for the rest of the meeting.

Progress now became easier, and I soon obtained an introduction to Messieurs Louis Bleriot, Henri Farman, and Levavasseur, the designer and builder of the famous Antoinette monoplanes, these three men, with, perhaps, in addition, Monsieur Voisin, being the only builders who were at that time more or less willing to take orders for aeroplanes.

After thoroughly discussing the pros and cons of these aeroplanes with their respective designers, I eventually made a contract with Monsieur Bleriot and agreed to purchase his large 80-horse-power, two-seated monoplane at

the end of the meeting. Unfortunately, however, disaster overtook this particular machine and Bleriot very nearly lost his life. Bleriot, Curtiss, Farman, and Latham were competing in the Gordon-Bennett International Aeroplane speed contest. Bleriot was hot favorite and Curtiss the runner-up, and these two men were working day and night trying to lighten their machines, with a view to obtaining the utmost speed possible, naturally cutting everything down to a very narrow margin of safety.

Bleriot's turn duly came, and when his huge eight-cylinder, 80-horse-power motor was started up, the roar of the free exhaust indicated to the public the huge power stored up in this machine, and expectancy ran high that a world's speed record was about to be established.

At the word of command, the eight or ten mechanics who were holding the machine back released their grasp and the machine literally shot up into the air. It was at once apparent that it was very much faster than the biplane driven by Curtiss, and indeed on the first lap it proved to be so. But the distance to be covered by the rules of the contest were three complete laps, and it was when a quarter of the way round on the second lap that the spectators were horrified to see the machine break into a mass of flames and drop from a height of a hundred feet a mangled wreck. Bleriot

Mr. Grahame-White getting away in his Bleriot monoplane. The mechanics have just released the machine, which is about to leave the ground, and the propellor is rapidly gaining full speed

Mr. Grahame-White getting away in his Bleriot monoplane. The mechanics have just released the machine, which is about to leave the ground, and the propellor is rapidly gaining full speed

was extricated from the débris, very severely burned about the hands and face, and badly bruised and shaken, but otherwise safe and sound.

Naturally every one was anxious to know what had happened and the cause of the fire, but it was not until several hours after that Bleriot recovered sufficiently from the shock to relate the cause of the accident.

It appeared that in his over-anxiety to get the machine ready in time none of the petrol connections had been properly brazed; India rubber tubing had been used to convey the petrol from the tank situated over the motor to the carburettor and petrol, being a very powerful solvent, had eaten through the rubber tubing and flowed on to the hot exhaust pipes, quickly igniting and setting the whole machine in a blaze.

Of course, a valuable lesson was learnt from this accident, — that greater care has to be exercised with all petrol connections on aeroplanes, or, for the matter of that, at all times when dealing with this very volatile and highly inflammable spirit.

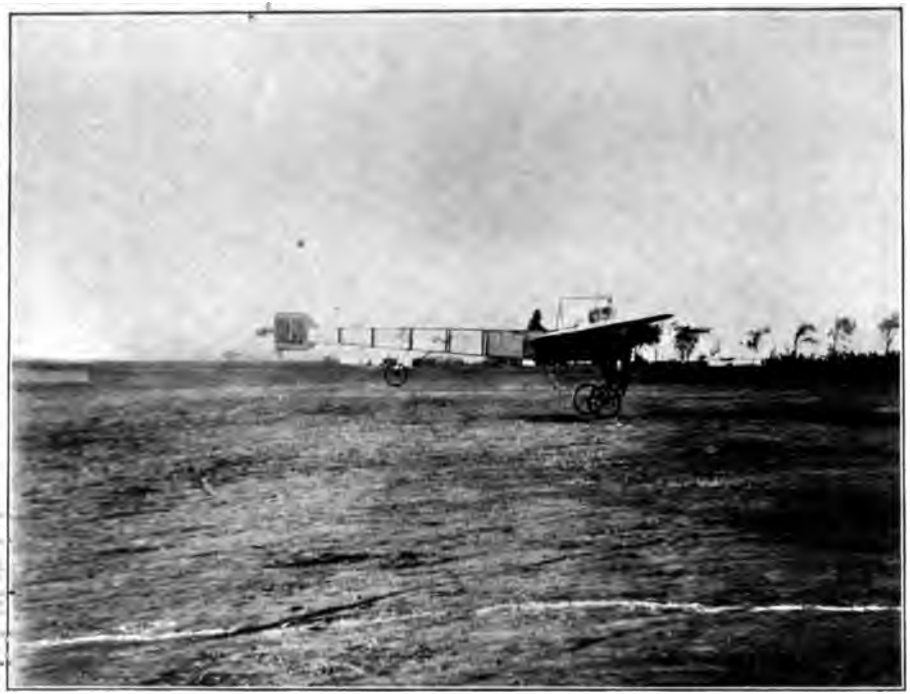
The destruction of this machine was of course a bitter disappointment to me, as there was none other in existence, and it required at least three months in which to build a duplicate. However, I obtained Bleriot's permission to go to

his works and superintend the construction of the new machine, but only on the strict understanding that I should adhere to the hours of his workmen, 6 A. M. to 6 P. M., and that I should place myself under the discipline of his works manager. This was somewhat distasteful to me but, as it appeared to be the only way to obtain an insight into the intricate construction of the machine and thus gain some practical knowledge, I gladly assented, and spent my whole time at the works until the machine was ready.

These three months passed very pleasantly, and I managed to get Bleriot to allow a friend of mine the same privileges accorded me. Eventually, we got delivery of the new machine, after sundry disappointments and various incidents too numerous to relate, on November 6, 1909. It was too late in the day to attempt any trials that day so we retired early, hoping for a calm, fine morning.

We had arranged for Bleriot's mechanics to turn up at dawn at the aviation grounds, which were about half an hour's motor drive from our hotel in Paris, but in our anxiety not to oversleep we became so restless that we got up at 2 A. M., and went out to the grounds, arriving, of course, hours before dawn.

It promised to be a glorious morning, though at first rather foggy, and as we both knew the



Mr. Grahame-White leaving for Boston Light to win the *Boston Globe's* $10,000 prize
Harvard-Boston Aviation Meet, Atlantic, Massachusetts, September, 1910

M to U

ground well, we got the machine out and patiently waited for the mechanics to turn up. Dawn arrived, and we were still frantically impatient to get the motor started up, but, having been warned by the foreman of the great danger of starting the engine, which has to be done by swinging the huge nine-foot propeller, we did not like to take the risk, especially as we were only two, and it required at least six to hold the machine back as soon as the engine was started.

After waiting a long time, however, we decided to risk it and to start "on our own," so we rigged up a sort of back arrangement with ropes, tying the machine up to a fence. It was then agreed that I should start the propeller and my friend should look after the ropes.

With fear and trembling we went to our respective posts, and, to my delight, the motor started up at the first quarter-turn of the propeller, but, as we had forgotten to take up the slack of the rope, the machine almost ran over me, and in fact did knock me down before I could get out of the way. I picked myself up, rushed round to the driving-seat and control levers, and beckoned to my friend to let go the ropes and jump in beside me.

Of course, as soon as my friend let go the ropes, off darted the machine, and it was with great difficulty and skill that he managed to

scramble into the machine. We were soon running along the ground at a speed of forty to fifty miles an hour, but on this first run I did not try to rise, as I was anxious to familiarize myself thoroughly with the engine controls before venturing into space. At the far end of the ground I slowed down to about 20 miles an hour, for I wanted to turn around, — a thing which, for a novice, is by no means a simple matter to accomplish with an aeroplane when on the ground, because as soon as the speed has been reduced the rudder efficiency is also proportionately reduced in precisely the same way that a sailing vessel is more difficult to steer with little or no way on. There are no brakes fitted to aeroplanes so that it is not easy to bring them quickly to a standstill. We were almost at the end of the ground, for we had misjudged our distance in the fog, and we found ourselves in imminent danger of running into the high boundary wall; so I shouted to my friend to jump out, hang on to the aeroplane, and drag himself along the ground to try to stop it. This he succeeded in doing within a few feet from the wall. This episode was something of a shock to us, for we had visions of the machine being a mangled wreck, but we did not dare to stop the engine and take a rest, for we knew that we should be unable to start it again without the ropes, petrol-squirt, and other tackle which we had left over a mile away.

We lifted the tail of the machine round and started off back again to the other end of the ground, and repeated this process for about twenty minutes. Finally I felt satisfied that I had control of the machine on the ground and was ready to try a flight. I shall always admire my friend's pluck in accompanying me on this, for us, memorable first flight, for in those days it was considered a most perilous undertaking to attempt a flight with even the most skilled aviator; so that for him to trust his life to a novice on the most powerful monoplane that had up to that time been built aroused my greatest admiration.

It is somewhat curious, let me say parenthetically, that my friend subsequently purchased a similar aeroplane, but has never been able to master its control and has given up aviation in disgust.

We started off to make our first ascent and, after obtaining our speed, I slightly raised the elevator. One can but faintly realize our delight and satisfaction to see that we were off the ground, had left all traces of vibration and jolting behind, and were really making our first flight in a heavier-than-air machine.

We soon reached an altitude of about thirty feet, which to us appeared a tremendous height, and I now began to think how to descend. This, I had been warned, was the most difficult

and perilous maneuver in flying. Our speed in the air was about fifty miles an hour, and to effect a safe landing at such a speed, as can well be imagined, is not a very easy task. We were fortunate enough to manage it all right, however, turning round again and making another nice flight back to the other end of the ground. The fog had now cleared and we were surprised to see, though it was still an early hour, a large number of people. We stopped near them and they all ran over to us, and in their usual excitable and demonstrative manner, so typical of the Frenchman, fairly went mad in enthusiastic praise of our flights.

The crowd turned out to be reporters, press photographers, etc., who had been brought along by Bleriot's mechanics in the cheerful hope, as I afterwards found out, of obtaining photographs and sensational matter of the anticipated "Wreck of an English Aviator's Monoplane," and, perhaps, they may even have fostered the fond possibility of my decease. They were doomed, however, to disappointment at making any such sensational reports, but they used their cameras and note-books busily enough, and the following morning I was ushered into the public gaze in all the newspapers, and was subsequently the proud recipient of a large number of congratulatory telegrams.

The news soon reached Monsieur Bleriot, who

was at that time giving exhibition flights at Vienna, and he immediately telegraphed me not to attempt any further flights. The ground, he said, was too small for such a fast machine, so he requested me to send the machine down to Pau, where Wilbur Wright had made most of his successful flights a short time previously, and where the ground was of ample extent and the weather most favorable for flying, on account of its sheltered position at the base of the Pyrenees. About ten days later I arrived at Pau with my machine, and was received by the Mayor and Corporation and accorded a civic welcome.

The arrangements at the railroad station for unloading such a large and bulky packing case were very crude and inadequate, and as there was no crane powerful enough to lift the case, we had to knock the case to pieces on the railway truck and get together an army of helpers to assist in lifting the aeroplane bodily off the truck. It was during this operation that our first disaster occurred, for at a critical moment, when it was half off and half on the truck, it overbalanced, owing to the difficulty I experienced in getting all these men to carry out my instructions accurately and quickly, the whole machine fell to the ground, a great deal of woodwork was broken, and a considerable amount of the light steel work twisted and strained.

soon up in the machine again ready for another flight; but my joy was doomed to a short life, for when making a sharp turn I lost control and the machine fell into a shallow river and was badly smashed.

This somewhat unnerved me, and I never yet have regained the same confidence I had prior to this accident; but this I attribute more to increased knowledge, and consequently the realization of the dangers attending the pursuits of aviation, than to any lasting effects due to the accident.

In a very short time I gained my pilot-aviator's certificate from the French Aero Club, which is a guarantee of efficiency in the art of aviation and without which it is impossible to give public demonstrations, flights, or to take part in any competition governed by the International Aeronautical Federation, under whose auspices all the principal meetings of the world are held.

I remained at Pau during the whole of the winter months of 1909–10. I established an aviation school there and soon had a number of pupils, both French and English; among my most adept and successful pupils that are now well known, I am proud to say, being the American aviator, Mr. J. Armstrong Drexel, who quickly mastered the art, and later made a world's record for altitude. Mr. Drexel rep-

Mr. J. Armstrong Drexel before starting on his altitude flight, Philadelphia, November, 1910

resented America at the Belmont Park Aviation Meeting in October, 1910, when I had the honor to oppose him as a representative of Great Britain.

Not very content with circling the Pau aerodrome and wishing to go further afield, I decided one day to make a cross-country flight from the aerodrome to the city of Pau, about twelve miles distant, and alight opposite the Casion. I chose a certain Sunday, one of the French National Fête Days, for the experiment.

On the afternoon in question there was a large crowd of people at the aerodrome. No one but my brother and sister and a few intimate friends knew of my project, for it was my intention to make a surprise flight into the town, but I had arranged for my mechanics to follow me in the motor car in case of accident. At about 5 P. M. I started off and, my machine running very well, I soon attained a height of about 700 feet, and immediately made off in a bee-line for Pau over the woods and forests. I was soon on the outskirts of the city, when to my horror my motor began to jib and run sluggishly and within a few seconds stopped altogether. This was my first experience of having to make a glide to earth with my motor stopped and I was naturally somewhat alarmed, especially as I was now over houses and the electric railway tracks. With more good luck than good judgment or manage-

ment, I cleared the roof of a house, to me it appeared by inches but no doubt it was by several yards, and alighted safely in a garden without so much as breaking a wire or a stay. My mother, who was following in a motor, was much unnerved when she saw that I was falling, and naturally much relieved when she came up and found that I was safe.

This accident proved to me that the motor I was using was unreliable and I immediately decided that it was foolish to trust one's life to the machine again, so I arranged to travel by the following day's night express to Paris to buy a machine fitted with a more reliable motor.

I was, however, persuaded by the crowd at the aerodrome on the day of my proposed departure to give one last demonstration flight, and although I was loath to do so, for a fairly strong breeze was blowing, I consented. For some unearthly reason I was suddenly taken with an overpowering desire to do something sensational as a wind-up, and so I conceived the idea of a glide down with my engine stopped facing the wind, a thing which up to that time had never been attempted, as it was considered dangerous to try this experiment against a head wind. I thought it would be a fine experience, however, in case my motor should ever stop from any cause when flying under similar conditions, so I headed

Mr. Grahame-White getting away in his Farman biplane. Note that the propellor is invisible on account of the speed with which it is revolving

for the wind and switched off at above 400 feet and in the usual manner dived for the ground. I soon found out that the head wind was causing my machine to lose its speed, and consequently I was losing control, and when I got within a hundred feet of the ground I realized that nothing short of a miracle could possibly avert a serious accident. I had little time for thought, for before I could think out any form of action the machine had struck the ground with terrible force, head first. I was thrown forward but my face struck one of the steel uprights in my fall, and before I could get up the machine had turned turtle on top of me.

I fell among a lot of gorse and bramble bushes, and when I managed to crawl out, I am told I looked for all the world like a hedgehog. The prickly gorse had stuck in all over my face which was bleeding very profusely from a deep cut right across my nose down to my right eye. Doctors quickly attended to me, and I was driven to the hospital at Pau where my wounds were stitched up. This little episode of course put a stop on my departure that evening for Paris, and the shock to my nervous system made it necessary for me to remain quiet for a few days.

It is such incidents as these, however, which teach one how to fly.

CHAPTER VII

THE SENSATIONS OF FLYING

A great many people have flown, and yet very few of them have given anything like a good explanation of what the sensations of flying really amount to. The explanation of this is fairly simple. It is extremely difficult for anybody to say exactly what he felt like when in the air.

The sensations are complex. The speed is great. Impressions come into one's mind at a very great rate. The result is that, when a man is back on the ground again, he is generally only able to gasp, and to wonder himself really what it all was like.

Naturally, when he is in a frame of mind like this, a man can scarcely be expected to give a very clear and a very lucid description of what it feels like to fly. More than one person, I am sure, has made a painstaking effort to analyze his sensations.

The result, however, has never been particularly happy. I myself have been interviewed times without number as to my sensations in per-

forming some particular flight. I am afraid, from the interviewer's point of view, my replies have never been particularly satisfactory. There is, as a matter of fact, a great deal of humor in this desire of people who remain on the ground to hear from others exactly what it is like in the air.

I remember, on some of the early occasions when flying, judged purely from the point of view of flying, was a far greater novelty than it is now, having seen incidents that amused me very much.

At one aviation meeting, a rather celebrated person was taken up for a flight. After making two or three circuits of the aerodrome, he was brought safely back to earth again. Immediately, half a dozen reporters, scenting a good "story," thronged round him, and began to question him closely as to his impressions.

He gasped a little, tried to straighten himself out and exclaim, "It was great." This observation, although very expressive, was scarcely ample enough to suit the men who had hoped to write half a column at least as to the views of this particular individual. So they waited a little, patiently, and then tried again. Evidently they hoped that the confusion of his rush through the air would pass away, and that the famous personage would, after all, say a few things that would be really noteworthy.

But his second declaration was scarcely more informing than his first. It was: "It's absolutely ripping." And although the newspaper men, true to their reputation for painstaking, did not desert him for some time, they practically failed altogether to get anything of a descriptive nature from the famous personage as to the sensations of flight.

The whole business amused me more than a little. The person in question was very well known, and particularly well known for his fluency of speech. It was, therefore, a striking illustration to me of a fact that I had realized before.

The first time a man flies the sensation is almost more than he can realize or express. The sensation, so to speak, sweeps his mind clear. He comes back to earth with nothing more than a sense of largeness and a good deal of awe. I mean, in the explanation given below, to convey in quite a matter-of-fact way really what happens when you start out on a flight in an aeroplane.

The first thing that one does is to take one's seat in the driver's position. In a biplane, the type of machine which I shall describe, one's accommodation is a small wooden seat. Some pilots, with a view to comfort, place a cushion on it. Others whom I have known, when undertaking a long cross-country flight, have removed the small wooden seat fitted by the makers, and have

Mr. Grahame-White and a passenger in a Farman biplane

substituted a comfortable wicker-work arm-chair. But such luxuries are only thought of, as a rule, by the very old hands.

In a biplane the pilot's seat is located in the center of the front of the lower main plane. To your right hand, as you sit, there is a lever. It is in the form of an upright metal rod, which moves on a universal joint. Wires lead away from it, by which you control the various planes of the machine. For instance, fixed out in front of you, on long wooden rods, is the elevating plane.

This is so made that it will tilt up and down, acting in unison with a small plane, having a similar motion, which is attached to the tail of the machine. This tail, in the form of two small planes, fixed one above another, is thrown out on wooden outriggers at the back of the main planes.

The rod, by a simple movement forward and backwards, actuates these elevating planes, as they are called. The rod has another function also. It moves from side to side, and in so doing operates what are known as the "ailerons." These are small planes hinged to the rear edges of the main planes.

Their work is very interesting. As the aeroplane passes along through the air it is being struck all the time by wind gusts. Some of them hit the planes more on one side than another.

The result is that the machine heels over a little sideways.

This is where the ailerons come into action. What the pilot does when he sees his machine beginning to drop on one side is to move his controlling lever slightly in the opposite direction to that upon which the aeroplane is falling. This action draws a wire, and lowers the ailerons — there are two of them — on the edges of the plane which is depressed. These ailerons, when tilted down, have the effect of raising the side of the machine which is heeling over.

With this simple control, the lateral stability of the machine is effected. There is one other controlling function which the pilot has to remember. As he sits in his driving seat he places his feet on a cross-bar, which is so made that it will move to and fro on a central pivot. From this cross-bar, on either side, run wires. These are carried right back to the tail of the machine, where they actuate a rudder which is exactly like that of a ship.

When the pilot wants to turn to the left, he pushes his foot forward on that side. The rudder comes round, and the aeroplane, obedient to its helm, moves round in the desired direction. Behind the pilot, as he sits perched in his seat, with the controlling lever in his right hand, and his feet on the rudder bar, are the engine and the propeller. Below him as he looks down are the

skids and running wheels which carry the aeroplane along the ground when it is starting on or returning from a flight.

The preliminary to a flight is the starting up of the engine. This is effected by one of the mechanics swinging the propeller until the engine gets to work.

To men who fly for the first time the noise of an engine is bewildering. No silencer is fitted. The result is that the engine, when accelerated ready for flight, makes a quite stupendous roar. The method, just before starting, is for the pilot to accelerate his engine and for a number of men to hold back the aeroplane.

This holding-back movement is necessary because when the engine is going "All out" the machine has a very strong tendency to move swiftly forward across the ground.

After he has accelerated, the pilot sits in his seat for a moment or so listening to his engine. If it is running without a miss, and everything seems all right, he lifts up his hand as a signal to the men to release their hold of the machine.

As they do so, it moves forward across the ground. At first its progress is slow, but it soon gathers speed, and when a pace of about thirty miles an hour is gained, the pilot knows that the moment has come to tilt up his elevator and take the air.

Nothing is more graceful than the way in

which an aeroplane leaves the ground. It does so without any suggestion of effort. All one sees, in watching it, is that the wheels, which a moment before were on the ground, are now passing along a foot in the air.

On this point it is curious to remember the experience of passengers, when starting upon a flight. So imperceptible is the change from moving along the ground to rising in the air that very few of them ever know when they have actually begun a flight. What happens is that they suddenly look down and discover that the ground has begun to fall away below them.

When you want to rise, you know perfectly well what to do. You tilt your elevator to a little more acute angle and the machine responds at once. Afterwards, well, as one flyer puts it, "You just fly." As you pass along through the air you very soon begin to lose the feeling that your engine is making a very great noise.

You find yourself glancing below. When you are flying fairly close to the ground the fields and country appear to be slipping away very fast. But as you ascend higher you lose this sense of speed. As a matter of fact, at a good height, you seem to be moving quite slowly.

As to the fascination of flight, what is it? I have studied it carefully, and have compared my own sensations with those of others. One of the best definitions you can find of the general feel-

ing a man has when he is flying is that it is a great, curious sense of power.

This may not seem a very satisfactory explanation to the reader, but it is one of the best I can give. I think that, in the back of one's mind when one is flying, is the realization that one is doing something that man has striven in vain to do for many centuries.

It is partly a feeling of conquest. And now you can imagine yourself climbing steadily upwards, with the ground fading away below. There is no finer sensation than this, I imagine. One of the most striking things in connection with flying is the responsiveness of one's machine to every controlling movement. While one is flying it is necessary to be making minor adjustments all the time. With one's rudder bar, for instance, one is always more or less occupied. The movements are, to some extent, instinctive. They are the sort of movements that a bicyclist makes to preserve the balance of his machine. All the time, while you are flying, your machine is being struck by little inequalities of air, and is showing a tendency either to move up or down or from side to side.

Therefore, the movements one makes are very small ones to correct this tendency. One's feet move just a little to and fro upon the rudder-bar. This little "joggling" of the rudder is sufficient to keep the machine on a straight course. As re-

gards the elevator, one is moving the rod in one's hand a matter of an inch or so only, and the same applies to the movements one makes in manipulating the ailerons.

A good deal of misconception exists as to the fatigue involved in making an aeroplane flight. Personally, I have found that fatigue is a negligible quantity, save when one is flying in gusty winds. Then, of course, the constant corrective movements that one is bound to make, and the strain of keeping so incessant a control of one's machine, is apt to have a very fatiguing effect.

But when one is flying under favorable conditions, I do not see that there is any strain at all. Of course, in the earlier days of flying, when engines were not so reliable, there was a certain strain upon a pilot, when flying across country, because he had a feeling in his mind that his engine might stop at any moment.

And the first pilots suffered from strain, no doubt, to a certain extent, because of their unfamiliarity with the air. Now, however, the strain in this respect is becoming less and less. Engines, too, are becoming more reliable. Men understand far better what to do when they are in the air. As a matter of fact, I think there is less actual strain in piloting an aeroplane across country than there is in driving a high-powered car from point to point along the road. Of course, as I have said before, the weather condi-

tions are all important. Sometimes, when flying, pilots suffer from cold. This is notably the case in winter flying.

In high flying, also, more than one airman has returned to earth with his hands completely numbed by the cold.

On a fine summer's day, however, flying is a magnificent experience. Personally I have not experienced any more really exhilarating sensation than one can find in flying under ideal conditions.

There is exhilaration, of course, in driving a well-found car on a good road, but this is a poor thing when piloting an aeroplane is compared with it.

To be in the air! To feel your motor speeding you on! To hold the lever and feel the machine while in flight answer to your slightest move! To look below and see the country unfolding itself to your gaze, and to know that you and you alone are the master of the situation — the man who is doing this wonderful thing! Realization of all these points gives you something of a feeling of awe.

Turning to another phase of flying, I am convinced that a judicious participation in aeroplaning provides a man with a very fine mental tonic. To begin with, he must always be ready for any emergency. I hear people very often talking about "Brain Fag." Business men, too, complain

very often that they want a change and need "bucking up." I already foresee that, in the future, flying will come to be regarded as one of the greatest health-givers. It will not be long, in my opinion, before doctors tell ailing men to go in for a course of aviation.

Naturally, before this result is attained, the machine will have to become much more perfect. That there are a number of very health-giving properties in flying, I do not think can be denied.

More than one man in indifferent health who has taken it up has, to my knowledge, improved quite remarkably in his physique. Of course, in its present stage, flying requires much more concentration and ability than will be the case in a few years' time. Its development as an amusement is only dependent on the perfection of mechanical details.

CHAPTER VIII

MY ATTEMPTS TO WIN THE *Daily Mail* £10,000 PRIZE

It was during the early days of April, 1910, after flying a Bleriot monoplane at Pau during much of the preceding winter, that I arrived in Paris and purchased a Farman biplane, which was promised for delivery by the middle of the month. At the same time that this purchase was effected, I cabled over making my official entry to compete for the *Daily Mail* £10,000 prize to be awarded to the first aviator of any nationality who should accomplish a flight in a heavier than air machine from London to Manchester, with only two stops en route for petrol and fuel, etc., the flight to be made within 24 consecutive hours.

Although the Farman biplane was an entirely different machine to control as compared with the monoplane I had been using at Pau, I soon mastered the manipulation, and accomplished a flight of 65 minutes in the evening of the first day's delivery. On the following day I per-

suaded my mother to board the machine and come for a flight with me.

At first she did not like the idea of it, as I had had so very little experience with the machine, and none with a passenger; but she assented, and as soon as we left the ground she lost all nervousness and thoroughly enjoyed the experience, and waved to all her friends below in a most unconscious manner.

We remained aloft about 35 minutes at an average altitude of about 300 feet, and covered some 25 miles during the time.

I then felt confident of the control of the machine and packed it up, and dispatched it to London, calling on the two Farman brothers on my way through Paris to acquaint them with my decision to make a determined and early effort to accomplish the London to Manchester flight, asking their coöperation and assistance.

They both expressed serious doubts as to my experience being sufficient to carry me through such an admittedly trying ordeal, and did their utmost to dissuade me from attempting the flight, at any rate until I had had some experience at cross-country flying. I, however, was determined to be the first aviator at any rate to make an attempt to win the prize, and would not listen to their advice and warning.

During this interview the Farman brothers informed me that Louis Paulhan was hurrying

back from America with the fixed intention of making an immediate attempt to win the same prize.

I hurried to London to see if my own machine had arrived, and to map out my route, and to get together all my road organization and supplies and spare parts, etc., at stopping places in case of accident.

I went and saw the directors of the L. & N. W. Ry. Co., whose main line I had decided to follow from London to Manchester, and we studied out the best and least hilly route. They very kindly placed a special train and inspection car at my disposal to enable me to travel over the entire course, and obtain an uninterrupted view of both sides of the track, so that I could select suitable landmarks to pick up my bearings when in flight.

In Manchester I searched for a suitable alighting ground, as by the rules governing the prize the aeroplane had to pass in flight within five miles of the London and Manchester offices of the *Daily Mail,* which meant that a considerable portion of the cities of London and Manchester had to be negotiated in flight. I selected eventually a fine, open field adjoining the railway track at Didsbury, which, on inquiry, I found was 300 yards inside the 5-mile limit.

I hurried back to London, and found that my machine was due up in London from New-

haven on the following morning. It duly arrived, and my mechanics set to work to rush it together with all speed.

Monsieur Henri Farman, the builder of my machine, turned up from Paris on the same evening, and immediately went up to Park Royal, my starting-point, to overhaul and see that the machine was being put together properly. Everything was hurry and bustle, especially as Farman informed me that Paulhan was on his way over to London and would be ready to start in about three days.

I decided that, weather permitting, the flight must start from Park Royal at daybreak the following morning, April 21, 1910.

At 4 A. M. I got up, and found it was a glorious morning, with a hard, white frost and a cold, light, easterly wind blowing. I arrived up at Park Royal at 4.30 A. M., just at the dawn, and found some 5,000 people already in attendance, but all my mechanics who had gone through a very strenuous time, were still asleep. We soon roused them and got the machine out into the open road for a start, but Farman advised me to wait a little to see if the wind would drop.

Shortly after 5 o'clock it certainly moderated so I decided to get under way. The engine was started, and I rose into the air after a short run precisely at 5.17 A. M. and steered straight

for the gasometers at Wormwood Scrubs, round which I was to circle, and on which the Aero Club and *Daily Mail* officials were stationed in order to verify my passing in flight within the prescribed 5-mile radius of *Daily Mail* office.

The huge recreation grounds at Wormwood Scrubs were a seething mass of people, it having been published that I should make my start from there, and I could hear their cheers above the roar of my engine as I passed 400 feet above their heads.

I was soon circling the gasometers, and then, in turning, I felt the force of the wind, which, owing to my machine's being very heavily ladened with 25 gallons of petrol, and about half that quantity of lubricating oil, caused the plane to lower very alarmingly, and I only cleared Willsden Junction Station by a few yards. But, when I once got clear of the streets and houses, I seemed to gain confidence, and gradually raised my machine to a much higher altitude.

I was now heading for Harrow and there appeared plenty of open country ahead of me. I was much interested in watching the hundreds of motor cars which I could see tearing along the roads, both ahead of me and in hot pursuit, as, of course, my whole route had been published days before, together with maps indicating my probable alighting places, and also the places along the route where I had stationed motor-cars laden with spare parts, fuel, etc.

Although I had had a specially warm wool-lined aviation suit made for me, and had as a precaution also put on three woolen sweaters underneath, I soon became bitterly cold, and I had to change hands with my control lever in order to restore circulation. I became so numbed that I was beginning to fear I should be forced to alight before my first fixed station, which I had chosen close to Rugby, about 83 miles from London.

I managed to hang on, however, but the cold affected me so much that when flying over Bletchley Junction, about 50 miles from my starting-point, I became quite faint, and, but for my brandy flask, which I had taken the precaution to place in my outside breast pocket, with the stopper already removed, and from which I was able to take a nip, I doubt if I should have been able to go on.

I chewed some chocolate after this, and seemed to get a bit warmer, but no one ever welcomed a station so much as I did when Rugby rose in sight, and I saw the white sheet spread out on the ground of a park where it was arranged I should descend.

There must have been some 20,000 people assembled here from the surrounding country, and I effected a safe landing right amongst them exactly at 7.14, or 3 minutes under 2 hours from the start at Park Royal, during

London to Manchester flight, April 23, 1910. Mr. Grahame-White leaving Rugby in his Farman biplane

which time I had covered 83 miles of the journey to Manchester, leaving 93 miles still to cover before 5.17 on the following morning, in order to win the £10,000 prize.

After landing I was so benumbed with the cold that I had to be lifted from my seat, and suffered agony with frost-bitten fingers until my circulation was restored.

Lord and Lady Dunbigh, who were the first to congratulate me on my flight, placed their brougham at my disposal, and drove me up to a neighboring farm for some hot breakfast; I soon felt quite fit, and was anxious to be off again.

After my fuel tanks had been replenished and the working parts overhauled, I gave the signal for the engine to be started at 3.15 P. M., and within a few minutes I was heading for Manchester.

By this time the wind had increased considerably in force and I soon found that I was traveling much more slowly than I had done up to Rugby. The wind had also changed to the northwest, and was now practically dead against me.

However, I soon passed over the railway station at Rugby Junction, the roof of which was fairly alive with railway porters, and hotel chefs in their pure white cooking outfits. Every one was waving flags and handkerchiefs, and the

host of railway engines in the sidings were all blowing their whistles.

No sooner had I passed the Station than I saw a network of diverging lines, some twelve different double tracks all going in different directions. Here, probably for the first time since leaving London, I found the great utility and absolute necessity of my having made arrangements to have the set of tracks, which I was to follow, whitewashed for some hundred yards up the fork. Now the wind seemed to have increased very much, and I noticed the branches of the trees were blowing about a great deal; gusts continually hit my machine, and I was pitching and tossing in all directions in a most alarming manner.

I was naturally much disturbed, but tried to console myself with the argument that if one flies in a wind one must of necessity expect to be buffeted about a bit, and in the same way that there is no cause for serious alarm when a ship is tossed about in an angry sea, I adapted this reasoning to the caperings of my aeroplane.

I, however, found that even if there was no cause for alarm, this gusty wind made a lot of hard work for me, and my right arm soon began to ache from the constant strain of having to work my ailerons to maintain my stability and keep the machine on an even keel.

I also noticed that, in order to keep over the

railway track, I was unable to hold my machine heading north, and owing to the wind being on my port bows, I was traveling crab-wise, and was rapidly drifting away from the railway tracks, which were to guide me to Manchester. I decided, however, that I must hold on at all costs, at any rate so long as I could see the railway lines in the distance and knew that I was traveling in the right direction.

Tamworth rose in sight, and on glancing at my route map, which I had had painted on the footboard just in front of my seat, I noticed that I had covered some thirty-five miles since leaving Rugby.

Although I had drifted some considerable distance away from the railway, I passed nevertheless over a thickly populated part of the town, and from my altitude was glad to notice that the lines took a fairly sharp bend, after leaving Tamworth, in my direction, which brought me directly over the line again, about a couple of miles outside the town.

Just as I was on the outskirts of the town, I was alarmed by the sudden stopping of the motor, and I immediately lowered my elevator and started to glide to earth, anxiously trying to decide which, amongst the roads and houses, would be the best landing-place, and the least likely to cause serious damage to my machine.

I must have dropped some 200 to 300 feet

when my motor, with a loud report (an explosion in the crank chamber), started to fire again, but very irregularly, and only on five cylinders out of the seven.

I thought it best, however, to try to fly on at any rate until I could get clear of the town, and as I was still at a safe altitude, I successfully passed over the town, and now had to literally nurse my machine along, and soon realized that I was rapidly losing my altitude and getting dangerously near to the tree-tops. Moreover, with lessened power and speed, I found the wind far more troublesome and the machine very difficult to control.

Reluctantly I had to make up my mind that a landing was essential, and so, choosing a fine, level meadow of ample size right adjoining the railway, I started to descend; but when about to alight, my motor again stopped, and with my power entirely gone just when I most wanted it to straighten the machine up to the wind, it failed, and in landing a side gust struck the machine and slightly damaged one of the skids.

My first thought on landing was to get to the nearest signal-box and telegraph all along the line to stop all my host of mechanics and assistants, who were tearing along after me in motor cars with oil, fuel, and every conceivable motor and aeroplane spare part.

As luck would have it, I found that I had

landed quite close to a level crossing where there was a signal-box, but I found that I could not with safety leave the aeroplane, as the wind was so strong that it was being lifted and was dancing all over the place, so that I was afraid that it might get blown over; and while I was wondering how on earth I could stake it down, as I was using all my strength to hold it down and did n't dare let go of it, a lot of farm laborers came running up, and within a very few minutes hundreds of people had collected around the machine.

One of these men I immediately sent over to the signal-box to wire messages up and down the line to inform my assistants where to locate me, but on arrival my messenger found that the signalman had already done all this, and he informed us that all the motor-cars had been stopped at Tamworth and Litchfield and were hastening to Hademore Crossing, the name of the village where I had landed.

During this time I was organizing a troupe of men to encircle the aeroplane to keep the crowd off, as every one's sole idea seemed to be an overwhelming desire to leave me their autographs on the canvas planes, much to the detriment of the canvas. Another gang of men I stationed at various points of the aeroplane to hold it down until my mechanics arrived.

People were arriving in thousands from all the

surrounding towns, and every sort and type of conveyance seemed to have been hurriedly called into service. The hundreds of motor-cars, the majority of which had followed the flight all the way from London and those which had joined the race en route, were simply pouring into the meadow, and the scene presented was as animated as a Derby race meeting.

It was not long before I saw my men breathlessly elbowing their way through the crowd, anxious to know that I and the aeroplane were safe and sound and to learn the cause of my unscheduled descent, as after leaving Rugby my second fixed and arranged-for landing-place was to have been at Whitmore, a village about 10 miles south of Crewe Junction, whereas this, my second landing, had been made some 18 miles south of that village.

My chief mechanic soon located the cause of my motor trouble, finding that one of the set of three delicate induction valve springs had broken on two cylinders, and, as I imagined, the last few miles had been flown with five cylinders only in operation.

The fitting of the new springs was a matter which occupied a few minutes only, and attention was in the meantime being given to the damaged skid, which did not demand any extensive repairs, so that the machine was very soon ready for flight again.

A host of my friends, whom I had last seen at five o'clock in the morning when I left London, soon turned up in their motor-cars with Mr. Roger Wallace, Chairman of the Royal Aero Club, Mr. Harold Perrin, and several friends. We held a sort of council of war as to the best tactics for me to adopt, in view of the very strong wind which was now blowing and was every minute increasing in force.

We soon decided that it would be madness to attempt any more flying until the wind moderated, and it was suggested that I should go to the hotel at Litchfield for some lunch and a rest, and if possible should make a fresh start at about 5 o'clock in the afternoon, as by that time conditions should be more favorable.

My first stop at Rugby and this, my second, landing now made it necessary for me to run right through to Manchester in one flight, in order to win the prize, as by the rules governing the contest only two landings were permitted. However, as I had only about another 60 miles to cover, my chances of success still looked very rosy, but I must admit that my fears as to the climatic conditions caused me no small anxiety.

I was very loath to leave the field, as I intuitively felt that it was essential for me to be in readiness to start again at the first indication of a favorable lull in the wind; but I was overpersuaded by my well-wishers and after

very stringent instructions to my mechanics to guard the machine jealously against all harm and to secure it to the ground with ropes and tent pegs, and on the personal assurance of Monsieur Henri Farman that he would not leave the machine for one minute, and would hold himself responsible for its safety, I went off at last to lunch at the George Hotel at Litchfield and turned in for an hour's rest after obtaining a promise from Mr. Roger Wallace that he would call me immediately should the wind moderate, and in any event not later than 4 P. M.

In due course I was awakened only to find that the wind had increased to a gale, but I decided at any rate to motor out to the field and see that everything was all right, and to instruct my men to be in readiness for me to make a start at any favorable opportunity during the night, so that I could reach my goal before 5.17 the following morning.

Most of my men slept under the machine and the Tommies kept watch all night. I returned to the hotel, and after an early dinner turned in and left my friends to keep watch and arouse me at the slightest sign of a possible resumption of the flight. Fate was, however, against me, but my friends awoke me at midnight, and although they knew it was useless, we all went on the roof of the hotel to view the conditions.

Since I had turned in at 7 P. M. it had been raining hard, and although it had now stopped there was an angry sky and a stiff breeze, and Farman strongly advised me not to resume the flight under such truly adverse conditions, especially as my aeroplane, which had been exposed to the storm, was soaked and would consequently be heavy and sluggish.

However, I did not like to give up my last chance without one supreme effort, so decided to motor to the field again and see if perhaps the conditions were quite so bad as they certainly appeared on the roof of the hotel.

It was, of course, pitch dark, and on arrival on the ground the scene was really a weird one, for hundreds of enthusiasts had remained by the aeroplane all night in the hope of witnessing the start, and small acetylene bicycle lamps alone lit up the extraordinary open-air dormitory which it for all the world most represented, every one being scattered about on the wet grass.

The sound of our arrival had a magical effect and soon everything was animation; every one cheered, and expectancy ran high for an early start.

Although the wind was still high and the plane very wet, I decided to make a start; but before I could get away it came on to rain and hail and started to blow up as hard as ever. I

saw that it was hopeless and madness to tackle a 60-mile flight in the dark over comparatively unknown country under such adverse conditions.

I announced to the crowd my decision and my disappointment in being forced to give up the flight, but informed them that immediately the weather was favorable it would be my intention to continue the flight to Manchester, and I would then start on another effort to earn the prize, this time in the reverse direction, namely, from Manchester to London.

After more cheering, hand-shakes, and good wishes, I returned to the hotel to bed, and was soon on my way to Manchester by aeroplane; but before I got there I awoke.

And so ended my first day's attempt to fly in a heavier-than-air machine from London to Manchester.

The following morning, Sunday, was fine, but very windy, so, there being no particular hurry, I went to church with my mother and sister, and for the first time prayers were asked for "those who travel by land, sea, and in the air," and indeed I had every reason to be thankful that no serious accident had overtaken me on such an adventurous flight. About 4 P. M. on Sunday afternoon on our way to the aeroplane we met a motor-car rushing along towards us and containing one of my mechanics and several friends. They excitedly singaled us to stop, and im-

mediately informed us that a strong gust of wind had just lifted the machine bodily off the ground and it had turned upside down and was completely wrecked.

In view of the fact that I had given strict instructions for the machine to be staked down and strongly tethered with ropes, I was somewhat naturally furious when on arrival at the grounds I found that my instructions had not been carried out, and that such a disaster should befall me with a hundred men guarding the machine was most exasperating.

I set to work at once to ascertain the extent of the damage, which, on examination, I found was very extensive, two bicycles having been forced right through the main planes and every upright and longitudinal smashed, to say nothing of the ailerons and the tail.

I immediately decided that the machine must be got back to London at once, so hurried for an express-covered truck, and by working hard all night we managed to get the entire machine dismantled and carted some 7 miles to Litchfield Station by 8 A. M. on Monday morning; and by midday the machine and my men had arrived at Willerden Junction, and before 2 P. M. it was all safely housed in the *Daily Mail* garage at Wormwood Scrubs.

I now organized a day and night shift of men to effect the repairs with the utmost dispatch,

as Paulhan had now arrived and was hurrying his machine up to London from Folkestone by road. By working day and night and personally giving my time and all the host of volunteer assistants, the machine was eventually ready for flight again by midday on Wednesday, or under 48 hours since I arrived back in London, and considering that it had practically to be entirely rebuilt, the record is not a bad one.

We were ready at Wormwood Scrubs for a start at dawn, April 27th, but there was a very nasty, gusty wind, and so any hope of getting away had to be temporarily abandoned. In the early hours of this morning, M. Paulhan's machine had arrived in London, and his mechanics were busily putting it together at Hendon, where, from some smooth, suitable fields, he had decided to make his start for the prize.

During the morning, finding it impossible to make a start, I decided to make a trial flight, to see that my repaired machine was in proper order. But the crowd on Wormwood Scrubs was so huge that it was only after several hours of strenuous work that my friends, assisting the police in their labors, were able to clear a sufficiently wide-open space for the purposes of a start.

Motor-cars were used by many of my friends to urge the spectators back. Although everybody was good-humored, the people did not seem

able to understand that it would be impossible for me to make a flight unless they stood well back.

Eventually, however, a space was cleared, and I brought out the machine about lunch time and flew her for a short, straight flight, finding the wind very gusty; but I assured myself that the repaired machine was in good order.

Then it became a matter of waiting for the wind to drop. There were, of course, some hopes of its doing so during the evening. We received news from M. Paulhan's hangar, at Hendon, that his machine was practically ready for a start, but that the aviator considered the wind far too high.

My mechanics having worked practically night and day for several days, I instructed them to have a rest, and went myself to a neighboring hotel, where, after a late lunch, I went to lie down and secure a little sleep.

I was resting here when the news came to me, from Hendon, that Paulhan had started for Manchester at 5.31 P. M. I hurried out upon the Scrubs, with the intention, of course, of getting away myself as quickly as possible. Reports which had been brought to me during the afternoon made it clear that the wind was both high and gusty.

It was a surprise to me, therefore, to hear that Paulhan had started, seeing that news which

had come to me from Hendon during the afternoon made it appear that he would not be likely to start at all that day.

Of course it was a question purely of flying in the wind. He was a more experienced aviator than I; and when I heard that he had braved a wind that seemed to be extremely treacherous and gusty, I decided to be off myself in pursuit, without any delay.

I determined, of course, not to waste a minute. The machine was got quickly out of its shed; some gentleman, whom I had never met before, very kindly helped me to button up the leggings of my aviation suit. All was hurry and bustle.

Friends wanted me to make another short flight to test the machine, but I decided this would be a mere waste of time. The engine was, therefore, started, and I got away at 6.29 P. M. So hurried had been my start that I forgot to take with me a map that had been prepared for me, and which was to have been placed on the footboard before me to indicate the route.

I found the wind still very gusty when I got into the air. However, I rose as quickly as I could, and, after a short half-circle of the Scrubs, passed directly over the *Daily Mail* garage, and headed for the gasometer I had passed round in my first flight.

The observers were in position here, and I saw the flag waving to assure me that I passed

within the necessary 5 miles of the *Daily Mail* Office. Then I headed off to Willesden Junction, and was soon flying out over the open country. My anxiety, naturally, was to get as far as possible before darkness fell. Paulhan, I knew, had an hour's start of me, which was a factor enormously in his favor.

The wind, I found, was not so troublesome as I flew on. As is so often the case, it began to fall perceptibly as nightfall approached. My flight, to the point at which I was compelled to descend owing to the gathering darkness, is best described in the following table:

Town.	Time of passing.	Miles from start.
Watford	6.50 p.m.	18
King's Langley	6.57 p.m.	21
Boxmoor	7.05 p.m.	25
Berkhamstead	7.11 p.m.	28
Tring	7.18 p.m.	32
Cheddington Junction	6.16 p.m.	36
Leighton	7.28 p.m.	41
Bletchley Jn.	7.35 p.m.	47
Wolverton	7.41 p.m.	53
Castlethorpe	7.45 p.m.	55
Roade	7.55 p.m.	60

At Roade I was obliged to come down. It was getting very dark, and I was afraid that, if I went on any further, I might make a bad landing when I did descend, and damage my machine. The flight to Roade had been practically uneventful. At the moment I had to descend, the conditions for flying were very good.

But there was nothing else for it. It would have been foolish to fly any further, and then have been obliged to come down somewhere when it was quite dark, thereby courting an almost certain accident.

I heard, soon after landing, that Paulhan, profiting by his hour's start, had been able to get, before darkness, as far as Litchfield, 117 miles on his journey to Manchester. This, of course, placed him in a far better position than I was in.

My friends arrived soon after I had come down, and a doctor at Roade very kindly asked me to come in his house and have a rest. While I was having something to eat, which I wanted very badly, we had a council of war as to what should be done next. The position, so far as I was concerned, looked very unsatisfactory.

Paulhan was a long way ahead of me. If we both started away from our respective resting-places at the dawn, he would inevitably, of course, reach Manchester long before I did. There was, naturally, the vague "sporting chance" that he might have to descend somewhere before reaching Manchester, thus allowing me to make up my lost ground. But, from the way he had been flying, and from what we knew of his careful methods, this was a comparatively remote contingency.

There seemed only one way for me to retrieve

myself, and get out of the bad position his hour's lead in starting from London had placed me in. I must, if possible, start off in pursuit of him before the dawn, and make up my lost ground by flying through the dark.

This was not a prospect, naturally, that one would face with complete composure. Night flying was, of course, entirely strange to me. The dangers of flying across country, which were great enough in the daytime, would, I knew, be infinitely increased if I dared to fly in the dark. Engine failure, for instance, compelling a descent, would, I realized, be a far more serious business at night, with no possibility of picking any landing-place, than a similar contingency when faced in broad daylight.

But, despite the risks, it seemed the only thing to do. We talked it over for some time, estimating the dangers, and discussing the difficulties of finding the way in the dark. More than one of my friends, possessing powerful headlights to their motor-cars, offered to guide me by shining the light of their lamps on the road ahead.

I thought myself that I should be able to follow the scattered lights along the railway line, in addition to being guided by the lights of towns. Of course, it was a doubtful business altogether; but occasions arise when drastic steps are all that are left for one.

It was decided at length that I should make the attempt. My friends naturally advised delaying my start as long as possible, so as to get whatever glimmer of light there was before the dawn.

After a nice rest, I went back to the field where my aeroplane was at about 2.30 A. M. It was then pitch dark, with no moon, unfortunately. The lanes all round the field in which my machine was standing were thronged with people. There were motor-cars everywhere. The scene was a strange one, — one, in fact, that I shall never forget

We waited some little time, thinking that the moon would perhaps appear. But it did not, and I was now anxious to be off. So, at 2.54 A. M., after a final word with my friends, I rose in my pursuit of Paulhan.

It was still completely dark when I got away. People were groping their way about the field with lanterns. As I had stood beside my machine, just before my start, there had been an utter blackness facing me, a little relieved, in the distance, by the twinkling of some small, scattered lights. These, I had been told, betokened the existence of Roade village and station.

My start was really something in the nature of a confused jumble. Faint lights swept away on either side as my machine moved across the ground. I could not judge my ascent at all, on

account of the darkness. But I elevated as quickly as possible, and got away from the ground smartly.

Directly I was at a respectable height, I could see the lights of the railway station very distinctly. I headed towards them. Looking directly down, I found that I could distinguish nothing on the ground below me. It was all a black smudge. I flew right over the lights of the railway station and — as I was doing so — my engine began to miss fire. It was certainly a very uncomfortable moment — one of the most uncomfortable I have ever experienced.

But, very fortunately for me, after a momentary spluttering, the engine picked up again, and fired properly. I had begun to sink towards the ground, upon which I knew I could have picked out no landing-place in the darkness. As soon as my engine began to do its work again, however, I rose and continued my flight smoothly.

One difficulty I experienced, however, was in gauging, accurately, whether I was ascending or descending. I had done no night flying of any kind before, but I became accustomed, by degrees, to watching the movements of my elevating plane which was silhouetted before me against the sky.

After leaving the lights of Roade behind me, I flew on for a while with scarcely anything at all to guide me. The gleam from an occasional

signal-box very far below helped me to some extent, however, and I was able to pick my way through the night to Blisworth, the next station along the railway line.

Here I had to bear away towards the left, in order to reach the next station, Weedon. I could not see the railway metals at all. Here and there, however, faint lights shone in the darkness. Some of them were the lights in cottage windows. Others, I felt sure, were the lights of motor-cars.

I passed over Weedon safely. Now, it seemed to me, my eyes were becoming much more accustomed to the darkness. On I flew. The sensation was really a very strange one. I felt completely alone in the darkness. The roar of my engine was in my ears. When I glanced back, small bright flashes of light, forming a ring, indicated the discharge of the exhaust from the motor.

Then I lost my way a little, having no railway lights to guide me. I steered too much off to the right. Then I turned back, but could not pick up the railway for a little time, and began to wonder what I should do. Fortunately, however, I saw some lights below me, and was able to find my way back upon the right course again.

At a little inn by the roadside near the village of Crick, one of my friends, Mr. Frederick

Coleman, had arranged with me to draw up his motor-car so that its lights shone upon the white-washed wall of an inn, and so act as a guide. I was on the look-out for this night sign, and was able to note it quite easily. I deviated a little from the railway line in order to pass over it. Whereupon, Mr. Coleman started his car, and tore down the road with the intention of acting as my guide.

I actually followed the car for a mile or so, flying directly over it. Then I saw that the roadway was bearing off too much to the right. A goods train came along the railway line at the moment. So I turned to the left and followed this, leaving the motor-car to continue along the road.

I flew after the goods train and soon overtook it. Then, in the distance, I saw the lights of Rugby. I flew right over the town and forged ahead. Now it began to get a little lighter. I began to see the railway lines beneath me, and to distinguish the country around.

But, with the dawn, a new difficulty assailed me. The wind began to rise in heavy, awkward gusts. I struggled on against it for some time. My machine jumped and danced about in a most surprising way. But still I managed to keep on. I passed over one railway station after another, with the light growing until it was perfect daylight.

I saw, however, that I should not be able to contend against the wind for very much longer. As I entered the Trent Valley, approaching Litchfield, a notoriously windy spot at all times of the year, I found the gusts so bad that they half turned my machine round in the air. I kept on a little while longer, but was then forced to descend near Polesworth, ten miles short of the spot Paulhan had reached the previous evening. The time of my descent was 4.14 A. M.

I came down in a very lonely field near the railway line, and did not see a single soul for more than half an hour. I could not leave my machine and look for the nearest railway signal-box, as the wind was so gusty it would have turned the aeroplane over. Presently, however, villagers began to stream up. It was not long before the field began to fill.

My friends arrived, too. Most of them had motored on, beyond my stopping-place, and had been obliged to hasten back when they heard of my descent.

Now the question came, "Has Paulhan got through?" We heard that he had started from Litchfield as soon as it was light, and had been reported well on his way to Manchester. There was nothing to do but wait.

It was at a quarter past six that the news came that Paulhan had actually reached Manchester, that the prize was won. There were cheers

raised. Very kind and sympathetic expressions of regret at my failure were made also. I sent Paulhan a telegram, congratulating him on his success, and told the waiting crowds that he was a great aviator, and I only a novice. Whereupon the crowd very kindly cried, "No, no," and there was more cheering.

That evening I made another flight, with the intention of reaching Manchester, but the fabric on one of the tail-planes of the machine became loose, after I had gone a few miles, and I was obliged to come down, especially as a storm threatened, and it was still very gusty.

And so this finished the contest. It was an extremely interesting and instructive experience for me. The long cross-country flights taught me a lot. And, as a memento of my race with Paulhan, I have a very beautiful cup which was presented to me by the proprietors of The *Daily Mail.*

CHAPTER IX

PAULHAN'S MEMORABLE LONDON-MANCHESTER FLIGHT

I am now going to describe the memorable flight made by M. Louis Paulhan when he effected an aerial journey from London to Manchester, a distance of 183 miles, winning the *Daily Mail* £10,000 prize.

There is an additional interest in this flight, at least from my point of view, seeing that M. Paulhan succeeded in beating me, and winning the prize. The story of Paulhan's flight is indeed a most dramatic one. Paulhan rose in fame with astonishing rapidity. It is certain that he won every penny of the £10,000 by making the flight he did. Although he was an exceptionally skillful and experienced pilot, the flight imposed upon him a strain that he had never experienced before. Not only was the distance more than that of any of his previous flights in France, but the course over which he had to fly was unfamiliar to him, and extremely difficult.

This point about the difficulty or otherwise of a country, so far as the flying man is concerned,

may need a little explanation to make it understandable by the ordinary reader. It would appear to anybody who had not studied the point that it would not matter much to an airman what the country was like below him, seeing that he was passing so easily through the air above it.

But there are several reasons why a pilot takes notice of the country over which he flies. In the first place, as I have mentioned before, the sort of country he is passing over is highly important to him should his engine fail and should he have to make an involuntary descent. Apart from this, the question of whether the country over which he is flying is flat, hilly, or wooded has a good deal of importance. If a man, for instance, is flying over a hilly piece of country, he will need to ascend to a much greater height than he would do were the land smooth. The explanation of this is that, if a machine passes fairly close to hills while the pilot is flying over them, he is frequently assailed by dangerous gusts of wind, which blow over the hilltop.

To a certain extent, also, this question of wind gusts or eddies is important when a flyer is passing over country which is thickly wooded.

The ideal country is one which is flat. Then, whatever wind there is, blows steadily, and the pilot does not need to exercise so much caution as he would do when passing over unfavorable country. In France, when flying from point to

point, pilots as a rule have many fine open spaces suitable for making a landing upon.

Thus the development of cross-country flying was much more rapid in France than has been the case in England. When more than one of the famous foreign flyers came to England, and saw what sort of a country it was for flying purposes, they shrugged their shoulders very expressively. More than one of them indeed declared that cross-country flying in England would not be safe until engines were extremely reliable.

As a matter of fact it is difficult to choose a route for a cross-country flight in England which does not pass over woods, hills, and towns. In making such a flight as this, an airman may find it necessary to pass over miles of country without seeing below him any spot that would make a suitable landing place should he be compelled to descend.

To plane to earth and land in a town would, of course, prove disastrous. Even if the pilot were sufficiently skilled to avoid coming to rest upon a house, he could scarcely hope to make a safe landing in a street, even if he could avoid the traffic. There are too many telegraph wires, chimneys, and such obstructions in a town to make any hope of a safe landing. Of course, if you picked a spot beforehand, and carefully thought out exactly how you were going to come

down, and also if the local authorities agreed to keep a space clear for you, it might be possible to make a descent in the main streets of many a town.

But, generally speaking, the risk when flying across country in England is far greater than it is when passing from point to point in France.

The cross-country flight from London to Manchester represented an undertaking of no mean order. In fact, more than one of the well-known airmen came to look over the course, and were not at all pleased with what they saw.

But Paulhan had done everything he could to prepare himself for the flight. He had been over the course in a motor-car, and also in a train. He had seen the places where it would be necessary to fly high in order to avoid dangerous currents of air blowing over hill-tops.

His aeroplane was very carefully assembled at Hendon, and on the day when he had decided to fly, all his preparations had been very carefully made. One cannot, when setting out upon such a task as this, spend too much time or trouble upon preliminaries. I foresaw that before my attempt for the prize. More often than not they spell success.

The day upon which the flight was made was a very awkward one. In the morning there was a good deal of wind, and it gave the impression of growing stronger as the day advanced. So,

as a matter of fact, it did. I had been waiting about at Wormwood Scrubs with the idea of starting, but the wind was certainly too strong.

Paulhan waited until the evening, and then seeing some improvement in the weather, he decided to start. After testing his engine to see that it was running properly he got away, rising to a good height in order to clear the country upon which there were houses, before he got free of the outskirts of London.

The flight from the beginning was an exciting one. It will be remembered that I followed Paulhan, and that there was something in the nature of a race between us. The wind was high. In the first stage of his journey, which carried him from London to Lichfield, Paulhan had quite as much as he could do to keep his aeroplane on an even keel. An interesting arrangement had been made whereby the friends of the airman could follow his progress. Seeing that the metals of the London and North Western Railway provided the best possible guide in making the flight between the two cities, it was decided that a special train should follow the pilot.

Starting from Willesden Junction very soon after he had got away, this special train, in which traveled the aviator's wife, kept pace with him more or less all the way. Thus it was possible for those in the train to see what a struggle M. Paulhan was having with the wind that assailed him.

The machine he was flying was of practically the same type as that I used. It was a Farman biplane, with a Gnome motor. The difference, however, between Paulhan's machine and my own was that his had the lower main planes cut away with the idea of giving the machine greater speed.

More than once, on the first stage of his journey, the pilot encountered some extremely nasty gusts. Those who were following him in the train saw the aeroplane dip and heel over in a way that was quite alarming. But Paulhan, fortunately, was a wind flyer of exceptional skill, and so he was able to keep on. Once or twice he experienced a very unpleasant sensation.

There are occasionally with winds of a certain character what airmen know as "holes in the air." This rather curious expression is used because it explains very much what the sensation of the airman is when he comes across one of these gaps. What an "air hole" is, really, is a sort of gap between two gusts of wind. The effect of it upon an aeroplane is curious. It is also very unpleasant for the flyer. When it comes to an "air hole" the machine, temporarily deprived of support for its planes, makes a drop earthwards. Some of these air holes are trifling affairs. Others give a pilot a very uncomfortable sensation indeed. Paulhan was exceptionally unfortunate in respect of the "air

holes " encountered during the first stage of his flight.

One or two of the first he met with were not so bad. But afterwards he ran into several which caused the machine to drop so abruptly and so alarmingly that the pilot had thoughts, once or twice, of descending to earth. But it was not in his nature to abandon a flight of such magnitude once it had been begun.

Describing one or two of his experiences in this respect afterwards, Paulhan declared: " It was worse than going down in one of the fastest lifts." So swift, in fact, were one or two of these drops, that Paulhan was almost thrown out of his driving-seat. He only saved himself by gripping very hard the upright rod or stay which came near his left hand.

As he neared the end of the first stage of his aerial journey from London to Manchester, Paulhan felt very tired indeed, and he was glad to make a safe descent, and wait a few hours, until early the next morning, before attempting to complete his flight to Manchester.

He had an exciting time when he was actually making the descent at his first halting-place. He had been flying on for some little time with twilight falling, looking around for a spot where he could alight. Delaying matters a little, he found darkness rapidly coming on, and decided that he would have to come down pretty quickly.

The field he chose was a good one, lying quite near the railway, and being of a smooth surface, but to approach it was a matter of great difficulty. The aeroplane had to be steered past a building with some tall chimneys and also over some very dangerous-looking telegraph wires. Paulhan's skill, in making this descent, was quite remarkable. The few hours which he had, before getting away again on his journey to Manchester, he made good use of by sleeping soundly.

The next morning, as soon as it was light, he was away. In fact, Paulhan used the very greatest judgment in achieving this flight. Had he not made a very prompt start upon the second stage of his journey, he would undoubtedly have encountered so strong a wind that he would have been obliged to descend.

So far as I was concerned, it will be recalled that, after starting away in the dark to overtake Paulhan, I was forced to descend owing to wind gusts.

It is not likely that Paulhan will ever forget that second stage of his flight to Manchester. The wind was very strong. No one, save the pilot who wrestled with it a thousand feet high, could realize how strong it was.

Had it not been that the prize was so great a one, and that it was more than half won, Paulhan would have inevitably descended. As it was he

battled on, providing a thrilling spectacle for those who followed him in the special train.

One of the occupants of this train has given me a brief account of what he saw. "When we got up in the morning," he said, "I never thought it would be possible for Paulhan to get away at all. The wind was not only strong. It was very gusty. And, what is more, it seemed to me that it would get stronger as the morning advanced. As a matter of fact, this is what it did do, and Paulhan was in the position of having to combat a stronger and stronger wind as he neared Manchester. The only thing that gave him the prize was the fact that he exercised such good generalship, and got away without any waiting about, so as to complete as much of the journey as he could before the wind got up.

"I do not suppose that anybody would ever witness again such a sight as we saw that morning. Realizing that there was nothing for it but to fly high, and so get all that there was in the way of steady wind, Paulhan climbed up pretty quickly after he had started. Even under these favorable conditions as regards altitude I do not think I have ever seen a machine roll about in the air as his did. He was, we could see, incessantly at work. One wind gust after another struck the machine, and it literally reeled under the shock.

"Up and down it went, and from side to side.

Paulhan's pluck and determination were remarkable. I do not think that any other man could have kept on with such determination as he displayed. It was a strange thing to see how the wind got worse and worse as the airman flew on. To us, in the train, it was a matter of question as to whether he would be able to win through. You can imagine our feelings. Here was the pilot with nearly all his journey done, and yet with a cruel wind conspiring to rob him of his goal, almost when it was in sight.

"The wind seemed to play him all sorts of tricks. Sometimes it blew sideways, sometimes in front. We could see him varying his altitude according to his idea as the best way of combating the wind.

"With immense courage, I think, he climbed up until he must have been at least fifteen hundred feet above the ground. Here, for the time being, he seemed to make better weather of it. It was quite clear to me that the only thing that kept him in the air was the fact that he had determined to fly high.

"Had a man been passing say three or four hundred feet above the ground, in such a gusty wind as that, he would have undoubtedly been blown down. As the minutes went by, towards the end of the journey, and we knew that Manchester was coming nearer and nearer, I must confess that our excitement grew greater. I do

not think that M. Paulhan's wife, or his French friends who were in the train, will ever forget those moments of tense anxiety. The unspoken question which flashed into everybody's mind was, 'Will he succeed, or will the wind beat him down when victory is literally in sight?'

"Presently, very far away, the smoke of Manchester came into view. It was clear that the airman could see his goal. He came down a little very cautiously. Every second now the tension upon us grew greater, particularly when, as though intent upon a final onslaught, the wind blew even more gustily. For several seconds, on more than one occasion, it appeared as though the aeroplane were completely at the mercy of the gusts. It heeled over more severely than it had done at any previous point of the flight. What I think, as a matter of fact, was that the pilot was becoming tired.

"He had had a dreadful time, and his arm, as he told us afterward, ached most terribly from the manipulation of the steering lever. Luckily — although it was scarcely luck, seeing that he had displayed such extraordinary skill — Paulhan got through all right. But it is a fact that, very shortly after he came to earth, such a wind was blowing as would have made it impossible for any man, however clever to keep in the air."

Paulhan, in his own words, gave a very strik-

Mr. Glenn H. Curtiss seated in the biplane with which he made his Hudson River flight from Albany to New York, May 29, 1910

ing idea of what he had gone through. "I would not make a flight like that again for ten times ten thousand pounds. I had a fearful time. It was n't the strength of the wind so much as the tricky way in which it blew.

"Cross-country flying in England is no joke, indeed. The last part of my flight resolved itself into a sort of a race against time — or rather against the wind. It was clear to me, when I first studied the morning, that the wind was going to rise gradually. But, having got more than half way to Manchester, there was no question of stopping, and I decided to push ahead. I think, once or twice when I had been flying before in France, I had met with a wind which was as high as the one I encountered in this last stage of my flight. But I had certainly never been up in one which had blown so gustily.

"In future, when I hear that a man is regarded as being a very fine cross-country flyer in England, I shall say that he is, indeed, a very clever man. It was really what you might call 'touch and go' with me once or twice just before I got to Manchester.

"My machine, however, was in perfect order, and the engine — what wonderful pieces of work these Gnome machines are — never gave me any trouble of the slightest kind.

"Had I had engine trouble, in such a wind as was blowing, my predicament would have been

indeed an awkward one. To plane down successfully, after an engine failure at 1,000 feet, would have been almost impossible. Of course, in such circumstances, I should have come down at as steep an angle as possible."

CHAPTER X

NOTABLE FLYING RECORDS

After having realized the difficulties of the earliest pioneers of flying, I think the reader should next be shown what has now become possible, even with the admittedly crude machines which we possess to-day. Therefore, in the next few sections of my book, I shall describe the most notable feats which have been achieved by the world's airmen.

Seeing that in no department of flying is the rapid progress that has been made more clearly demonstrated than in the making of long flights, I have had prepared a list giving sixty of the most interesting of these performances. It is appended herewith.

One could not very well have a more definite proof of the advance made with aeroplanes than in comparing the first and the last flight as recorded on this list. From 55 minutes in the air, the time gradually creeps up until we see that a man has remained aloft for 8 hours 35 minutes.

At the time of writing this flight constitutes a record, but there is no reason why it should

do so for long. Ten and twelve hour flights, and even longer in the air, are sure to be made. M. Tabuteau, whose 8 hour 35 minute flight represents the most astonishing thing yet done in long-distance work, was flying, at the time, a Maurice Farman biplane, fitted with an air-cooled Renault motor.

During the long period he was in the air, M. Tabuteau circled round and round an aerodrome. He was competing for the Michelin long-distance prize, and was compelled therefore to keep to a given track.

A year or so ago, had it been declared that a man could steer an aeroplane for such a length of time without coming to the ground, apart altogether from the question of his engine running for so long, the person making such a statement would have been laughed at as a wild dreamer.

Yet M. Tabuteau made the flight without any inconvenience at all. Warmly wrapped up, he circled the aerodrome with absolute precision. Were it, as some people still allege, an extraordinarily difficult and nerve-racking business to fly an aeroplane, it would have been impossible for this pilot to have remained aloft for this length of time.

Had he done so, even, he might have been expected to return to earth a complete wreck. As it was, however, M. Tabuteau complained

FLIGHTS FOR DURATION AND DISTANCE

Time	Airman	Distance and Details	Place	Date
8h. 35m.	Tabuteau	365 miles	Buc	Dec. 30th, 1910
8h. 23m.	Farman, H.	288¼ miles	Etampes	Dec. 18th, 1910
7h.	Farman, H.	291¼ miles	Etampes	Dec. 31st, 1910
6h. 9m.	Marie, Pierre	333 miles	Buc	Dec. 31st, 1910
6h. 1m.	Tabuteau	290 miles	Etampes	Oct. 28th, 1910
5h. 59m.	Legagneux	322 miles	Pau	Dec. 21st, 1910
5h. 5m.	Renaux	223¾ miles	Buc	Dec. 31st, 1910
5h. 3m.	Olieslagers	245 miles	Rheims	July 10th, 1910
5h. 3m.	Breguet	242 miles	Douai	Dec. 31st, 1910
4h. 47m.	Cody	189 miles	Laffan's Plain	Dec. 31st, 1910
4h. 37m.	Labouchere	212½ miles	Rheims	July 9th, 1910
4h. 34m.	Sopwith	174 miles	Brooklands	Dec. 31st, 1910
4h. 22m.	Farman, H.	150 miles	Chalons	Nov. 3rd, 1909
4h. 7m.	Sopwith, T.	150 miles	Brooklands	Dec. 31st, 1910
4h.	Camerann, Lieut.	145 miles	Chalons	Dec. 21st, 1910
3h. 54m.	Ogilvie, A.	147½ miles	Camber	Dec. 28th, 1910
3h. 12m.	Sopwith, T.	140 miles	Brooklands	Nov. 26th, 1910
3h. 11m.	Cattaneo	144 miles	Lanark	Aug. 10th, 1910
3h. 5m.	Welsh	....	St. Louis	Oct. 11th, 1910
3h. 4m.	Farman, H.	112 miles	Rheims	Aug. 27th, 1909
3h.	Weymann	147½ miles	Nerondez	Sept. 7th, 1910
2h. 50m.	Cody	115 miles	Laffan's Plain	Dec. 22nd, 1910
2h. 49m.	Paulhan	96 miles	Brooklands	Nov. 1st, 1909
2h. 45m.	Farman, H.	100 miles	Mourmelon	Dec. 31st, 1909
2h. 43m.	Paulhan	82 miles	Rheims	Aug. 25th, 1909
2h. 41m.	Rougier	87 miles	Berlin	Oct. 1st, 1909
2h. 38m.	Jennin	....	Berlin	May 13th, 1910
2h. 35m.	Olieslagers	125 miles	Rheims	July 8th, 1910

[Table continued on reverse of page.]

2h. 35m.	Dutrieu, Mlle.	105 miles	Etampes	Dec. 21st, 1910
2h. 34m.	Grahame-White	90½ miles	Bournemouth	July 11th, 1910
2h. 32m.	Delagrange	125 miles	Juvisy	Dec. 30th, 1909
2h. 30m.	Cody	100 miles	Laffan's Plain	Nov. 4th, 1910
2h. 27m.	Sommer	....	Chalons	Aug. 7th, 1909
2h. 21m.	Englehardt	....	Berlin	May 13th, 1910
2h. 20m.	Christiaens	84 miles	Bournemouth	July 11th, 1910
2h. 20m.	Wright, Wilbur	93 miles	Le Mans	Dec. 31st, 1908
2h. 13m.	Latham	96½ miles	Rheims	Aug. 26st, 1909
2h. 10m.	Sommer	....	Bouy	Aug. 4th, 1909
2h.	Wachter	....	Mourmelon	May 15th, 1910
1h. 54m.	Olieslagers	96¾ miles	Rheims	July 8th, 1910
1h. 54m.	Wright, Wilbur	95 miles	Le Mans	Dec. 13th, 1908
1h. 54m.	Lambert, Count	72½ miles	Rheims	Aug. 26th, 1909
1h. 53m.	Englehardt	80 miles	Berlin	Nov. 5th, 1909
1h. 50m.	Sommer	....	Chalons	July 19th, 1909
1h. 50m.	Herveu, Mlle.	62¼ miles	Pau	Dec. 31st, 1910
1h. 50m.	Dubonnet	62½ miles	Issy	April 3rd, 1910
1h. 36m.	Paulhan	....	Tournai	Sept. 13th, 1909
1h. 35m.	Wright, O.	....	Berlin	Sept. 19th, 1909
1h. 32m.	Paulhan	....	Dunkerque	Aug. 7th, 1909
1h. 32m.	Farman, H.	47 miles	Blackpool	Oct. 20th, 1909
1h. 30m.	Lesseps, Count	....	Issy	Dec. 16th, 1909
1h. 24m.	Latham	62½ miles	Rheims	July 5th, 1910
1h. 21m.	Wright, O.	....	Fort Myer	July 20th, 1909
1h. 19m.	Leblanc	62½ miles	Rheims	July 5th, 1910
1h. 15m.	Wright, O.	....	Fort Myer	July 27th, 1909
1h. 6m.	Cody	41 miles	Laffan's Plain	Sept. 8th, 1909
1h. 5m.	Singer, M.	41 miles	Chalous	Dec. 21st, 1909
1h. 5m.	Dubonnet	43 miles	Juvisy	April 23rd, 1910
1h. 2m.	Tissandier	....	Pau	May 20th, 1909
55m.	Fequant, Lieut.	61 miles	Chalons	July 7th, 1910

of nothing more serious than the monotony of continually going round and round his course for so long a time. This feat, in which the airman met with no inconvenience at all save that of becoming "bored" with the performance, strikes me as affording one of the most conclusive evidences of the growing practicability of the aeroplane.

Farman, whose flight of 288¼ miles comes second on the list, prepared a special machine with which to undertake the flights for the Michelin trophy. Besides placing on it extensions to the main planes, in order that it might lift the weight of petrol and oil necessary for so long an aerial journey, Mr. Farman arranged very ingeniously for his own comfort. Instead of sitting upon a small, exposed seat, such as is usually embodied in the Farman machine, the pilot had built a sort of motor-car body.

This was fitted to the machine in the ordinary place. It was a kind of torpedo body, with a wind shield which protected Mr. Farman to a great extent from the cold. He ascended with food and drink with him, and made himself as comfortable as possible during his aerial journey, which lasted for 8 hours 22 minutes.

All the time, Mr. Farman was circling a course, as M. Tabuteau had done. In order to give himself a rest while flying he had had the steering-lever removed from its ordinary posi-

tion at the pilot's right hand and fixed between his legs.

In this way, he was able to use one hand and then the other to control his machine. It is interesting to note, also, that on the straight portions of the flying course he was able to let go of the lever with both hands and keep his aircraft straight by shifting the lever slightly, when necessary, with his knees.

This is another indication of the stability of the aeroplane. It rather destroys the view of some people who are still prejudiced against flight. They draw pictures of the airman, when he is aloft, sitting with strained countenance and convulsively gripping his levers as though, were he to take his hand away from one for the veriest instant, it would be sufficient to send him dashing to his death.

As a matter of fact, on a fine day, an aeroplane in flight requires very little attention at all. A very slight movement of the lever every now and then is all that is necessary.

Chief amongst the English long-distance flyers must be placed Mr. S. F. Cody. On December 31st, 1910, at Laffan's Plain, Mr. Cody flew for 4 hours 47 minutes. This performance was all the more creditable seeing that it was made on a biplane which was entirely of his own construction.

Mr. Cody has spent several years in a study of

aviation. During that time he has pursued many original lines of research. He has refused to be discouraged by adverse circumstances. Nothing has, in fact, daunted this intrepid pioneer. Greatly to his credit as an engineer is the workmanlike finish of his machine. He has also devoted an immense amount of attention to aeroplane engines. Few men know more than he does about their peculiarities. Mr. Cody is, indeed, a born engineer.

Of course, the question of these long-distance flights is one in which the development of the engine is all important. Had it not been that the makers of aeroplane motors had increased the reliability of their products to a very remarkable extent, such flights would have been impossible. In the beginning, aeroplane motors had to be coaxed to make a flight of even a few minutes. Now, when wanted, such a motor can run on at high speed for more than 8 hours without failing.

Fifteen of the flights which head the list I have given are of 4 hours' duration and longer. Surely no more encouraging sign is wanted than this? Its motor is the heart of the aeroplane; and there is every indication that difficulties in connection with it are being overcome.

One of the most important developments of flying has been the making of cross-country journeys. In the section of my book which fol-

lows I shall deal with the most notable of these flights. In order that the strides which have been made may be clearly understood I have prepared a list of some of the most notable performances in this direction. This list I insert here. It comprises the most meritorious flights achieved during the last two years by famous pilots.

A year or so ago, when flying was in its infancy, the idea that a voyage through the air between Paris and Brussels and back in a power-driven aeroplane would be achieved before the end of 1910 would have been regarded as a wild and impossible dream.

Yet so great has been the progress made in aviation that we find this flight actually accomplished in October last. Adding to the remarkable nature of the flight was the fact that the pilot, M. Wynmalen, carried with him a passenger.

The flight was made with seven stops. As an illustration of the practicability of the aeroplane, these halts were very valuable. They meant the ability of the pilot, as he flew along, to pick out a suitable landing spot in country that he had not seen before, and make a safe descent, despite the additional weight of the passenger. The halts indicated also that the pilot was able, in each case, to rise again from the land upon which he had descended. This flight, which

Airman	Distance — Time — Details	Date
Wymmalen, H. . . .	Paris to Brussels and back to Paris. 530 miles with passenger. 7 stops. Actual time of flights about 15 hours.	Oct. 16–17, 1910
Weyman, A.	Buc (Paris) to Clermont Ferrand. With passenger. 3 stops. 231 miles.	Sept. 7th, 1910
Sopwith, T.	Eastchurch to Beaumont, Belgium. 174 miles non-stop.	Dec. 18th, 1910
Bielovucie	Orleans–Chatellerault–Angoulême. 202 miles. 1 stop. 7h. 55m.	Sept. 2nd, 1910
Paulhan	Buc–Chartres. Chartres–Buc. Twice. 200 miles.	Aug. 11th, 1910
Bellanger, Lieut. . .	Vincennes–Chalons and back to Chalons. 200 miles.	Sept. 29th, 1910
Paulhan, L.	London–Manchester. 185 miles. 1 stop. 4h. 12m.	April 27–28th, 1910
Brookins, W.	Chicago to Springfield. 2 stops. 187 miles.	Sept. 30th, 1910
Hamilton	New York–Philadelphia and back to New York. 160 miles. 3h. 28m. 2 stops.	June 13th, 1910
Curtiss	Albany to New York. 1 stop. 150 miles. 2h. 50m.	May 29th, 1910
Cammerman, Lieut. .	Chalons–Monsigny–Troyes–Chalons. 145 miles non-stop. With passenger.	Dec. 21st, 1910
Maillois, Lieut. . . .	Etampes–Blois and back to Etampes. Non-stop with passenger. 127 miles.	Nov. 26th, 1910
Bielovucie	Orleans to Chatellerault. 111 miles.	Sept. 2nd, 1910
Paulhan	Chevilly–Arcis-sur-Aube. 110 miles.	April 18th, 1910
Paulhan	London to Lichfield. 108 miles. 2h. 39m.	April 27th, 1910
Latham	Issy-les-Moulineaux–Chalons. 106 miles. 3 hours.	Aug. 12th, 1910
Leblanc	Troyes–Nancy. 103 miles. 2h. 19m.	Aug. 9th, 1910
Aubrun	Troyes–Nancy. 103 miles. 2h. 27m.	Aug. 9th, 1910
Legagneux	Troyes–Nancy. 103 miles. 5h. 31m. 1 stop.	Aug. 9th, 1910

[Table continued on reverse of page.]

Fequant, Lieut.	Mourmelon–Vincennes. 100 miles with passenger. 2h. 30m.	June 9th, 1910
Leblanc	Nancy–Mezieres–Charleville. 100 miles. 2h. 6m.	Aug. 11th, 1910
Aubrun	Nancy–Mezieres–Charleville. 100 miles. 3h. 41m.	Aug. 11th, 1910
Martinet	Mourmelon–Neuf Moutiers. 99½ miles. 1h. 28m.	May 23rd, 1910
Bielouvcie	Chatellarault–Augoulême. 91 miles.	Sept. 2nd, 1910
Leblanc	Issy-les-Moulineaux–Troyes. 84½ miles. 1h. 32m.	Aug. 7th, 1910
Aubrun	Issy-les-Moulineaux–Troyes. 84½ miles. 1h. 37m.	Aug. 7th, 1910
Lindpainter	Issy-les-Moulineaux–Troyes. 84½ miles. 2h.	Aug. 7th, 1910
Leblanc	Mezieres–Charleville–Doual. 84½ miles. 2h. 20m.	Aug. 13th, 1910
Aubrun	Mezieres–Charleville–Douai. 84½ miles. 3h. 3m.	Aug. 13th, 1910
Grahame-White	London to Rugby. 83 miles. 2h. 5m.	April 23rd, 1910
Bielovucie	Issy-les-Moulineaux–Orleans. 78 miles. 1h. 15m.	Sept. 1st, 1910
Leblanc	Amiens–Issy-les-Moulineaux. 75 miles. 1h. 53m.	Aug. 17th, 1910
Aubrun	Amiens–Issy-les-Moulineaux. 75 miles. 2h. 3m.	Aug. 17th, 1910
Dubonnet	Juvisy–Le Ferte St. Aubin. 62½ miles. 1h. 50m.	April 3rd, 1910
Leblanc	Douai–Amiens. 50 miles. 1h. 8m.	Aug. 15th, 1910
Aubrun	Douai–Amiens. 50 miles. 1h. 25m.	Aug. 15th, 1910
Farman, Henry	Etampes–Chevilly. 50 miles	April 17th, 1910
Farman, Maurice	Buc–Étampes. 50 miles.	May 21st, 1910
Cody, S. F.	Laffans Plain and surrounding country. 50 miles. 1h. 6m.	Sept. 8th, 1910
Sommer	Mouzon–Sedan and back to Mouzon. 50 miles. 1h. 10m.	May 15th, 1910
Grace, C.	Eastchurch–Sheerness and surrounding country. 1h. 6m.	Sept. 3rd, 1910
Grahame-Gilmour	Brooklands–Hampton Court with passenger. 40 miles.	Sept. 13th, 1910
Lambert, Comte	Juvisy–over Paris–Juvisy. 49m.	Oct. 18th, 1909
Bleriot	Étampes–Chevilly. 27 miles. 43m.	July 13th, 1909
Paulhan	Los Angeles. 22 miles with passenger. 33m.	Jan. 19th, 1910
Dutrieu, Mlle.	Blankenberghe–Bruges–Blankenberghe. With passenger. 20 miles.	Sept. 2nd, 1910

was in the nature of an aerial tour, did a great deal towards showing the public what could be done by aeroplanes.

For this summer (1911), already, a number of such aerial tours have been arranged. What is wanted is for some pilot to start away and pay visits for a week or two by means of the aeroplane, carrying his luggage with him, and treating the aircraft exactly as though it were a motor-car. Such a project is perfectly feasible. M. Wynmalen's three-hundred-and-fifty-mile flight is certain to be exceeded during 1911, seeing that in one contest alone the scheme is to visit several of the capitals of Europe, including London.

Following upon the achievement of Monsieur A. Weyman, who figures second on the list of long-distance cross-country flyers with a 231-mile journey from Paris to Clement Ferrand with a passenger, comes — I am glad to state — the performance of an English airman, Mr. T. Sopwith.

In the De Forest contest, which was for the longest aerial journey into France, made by a British pilot on an entirely British-built machine, Mr. Sopwith achieved a splendid 174-mile journey into Belgium.

His performance was all the more remarkable and creditable, seeing that this flight constituted the first occasion upon which Mr. Sopwith

had flown across country. Previously, his flying had been done at the Brooklands aerodrome. At the time he made his flight, Mr. Sopwith had only been piloting an aeroplane for a few weeks.

The British-built machine which he used was a biplane constructed by Mr. Howard Wright. Driving it was an E. N. V. engine of the type built in England. It had eight cylinders, and developed 60 to 80 horse-power.

Mr. Sopwith carried with him on his flight a sufficient amount of petrol for a seven-hour journey. Actually, he was in the air for three hours and forty minutes. He flew all the time at a high speed owing to the fact that he was aided by a following wind. Mr Sopwith crossed the English Channel between Dover and Cape Grisnez.

Of the other flights that one sees in the list, a good many of them have been achieved by military airmen. This is a notable fact. It shows that airmanship, as applied to the army, is a very real thing. In France, particularly, where most of these long cross-country flights have been made, the officers engaged in the air service betray the greatest keenness to eclipse each other's performances

First on the list is Lieut. Bellanger, who flew from Chalons for a two-hundred-mile cross-country tour on Sept. 29, 1910. This flight was undertaken with a view to demonstrate how use-

SPEED — (*Aviator only*)

Kilometres	Miles	Airman	Time	Place and Date
1	5/8	Radley	47 2/5s.	Lanark, 13/8/10
5	3 1/8	Leblanc	2m. 44 78/100s.	Belmont Park, 29/10/10
10	6 1/4	"	5m. 30 92/100s.	Belmont Park, 29/10/10
20	12 1/2	"	11m. 4 78/100s.	Belmont Park, 29/10/10
30	18 3/4	"	16m. 38 31/100s.	Belmont Park, 29/10/10
40	25	"	22m. 12 58/100s.	Belmont Park, 29/10/10
50	31 1/4	"	27m. 48 70/100s.	Belmont Park, 29/10/10
60	37 1/2	Morane	39m. 32 3/5s.	Bordeaux, 18/9/10
70	43 1/4	"	46m. 19 1/5s.	Bordeaux, 18/9/10
80	50	"	53m. 5s.	Bordeaux, 18/9/10
90	56 1/4	"	59m. 52 2/5s.	Bordeaux, 18/9/10
100	62 1/2	Grahame-White	1h. 0m. 47 73/100s.	Belmont Park, 29/10/10
150	93 3/4	Aubrun	1h. 43m. 19 3/5s.	Bordeaux, 9/9/10
200	125	"	2h. 18m. 30 3/5s.	Bordeaux, 9/9/10
250	156 1/4	Pierre-Marie	3h. 4m. 28 1/5s.	Buc, 31/12/10
300	187 1/2	" "	3h. 40m. 55 2/5s.	Buc, 31/12/10
350	218 3/4	" "	4h. 17m. 26 1/5s.	Buc, 31/12/10
400	250	" "	4h. 54m. 6 4/5s.	Buc, 31/12/10
450	281 1/4	" "	5h. 30m. 35 3/5s.	Buc, 31/12/10
500	312 1/2	" "	6h. 7m. 7 4/5s.	Buc, 31/12/10

SPEED (*continued*).—(*Aviator with passenger*)

Kilometres	Miles	Airman	Place	Date	Time
10	6¼	Laurens	Buc	Dec. 21st, 1910	7m. 31 1/5s.
20	12½	"	"	Dec. 21st, 1910	15m. 14 2/5s.
30	18¾	"	"	Dec. 21st, 1910	22m. 56 2/5s.
40	25	Vidart	Mourmelon	Dec. 31st, 1910	29m. 40s.
50	31¼	Laurens	Buc	Dec. 21st, 1910	38m. 19 2/5s.
100	62½	"	"	Dec. 21st, 1910	1h. 16m. 51s.

SPEED.—(*Aviator with two passengers*)

Kilometres	Miles	Airman	Place	Date	Time
10	6¼	Mamet	Rheims	July 3rd, 1910	10m. 18 4/5s.
20	12½	"	"	July 3rd, 1910	21m. 14s.
30	18¾	"	"	July 3rd, 1910	31m. 53 1/5s.
40	25	"	"	July 3rd, 1910	42m. 32 3/5s.
50	31¼	"	"	July 3rd, 1910	52m. 56 1/5s.

ful the aeroplane could be in war-time for carrying out an extended survey of the country round. This question of aeroplane in war I shall deal with exhaustively later on.

In regard to notable performances made by airmen in speed-flying, high-flying, cross-Channel and over-sea flights, also in aerial journeys with passengers, and in cross-country flights in stages, I propose to make one section of my book cover this field.

I shall first deal with speed flying. Appended are the chief speed flights as now recognized by the International Aeronautical Federation.

In connection with speed flying, I have dealt so fully with the question in other parts of my book, that all one can say here is that the aim of constructors is now to increase the speed of their machines.

This is not done with the mere desire for speed itself, but to give an aeroplane power to fly in higher winds. At present, with speeds of forty, fifty, and sixty miles an hour, aeroplanes are able, occasionally, to venture aloft in winds of twenty and twenty-five miles an hour. If the ideal can be reached, which is a speed of one hundred miles an hour, it is hoped that aviators will be independent of any wind short of a gale.

I now give a list of the principal high flights which have been made.

After studying this list of high flights, a reader may well ask "What is the limit?"

The answer is rather a difficult one. In the early days of flying more than one person declared that one thousand feet would represent the greatest height it would be possible to reach. But that was very soon proved to be wrong. Then some experts declared that five thousand would be the limit. Here again, however, they were proved to be wrong. One of the most expert of flying men predicted, during the summer of 1910, that ten thousand feet would certainly be as high as it would be practicable to fly, seeing that, after such an altitude had been reached, the motor on an aeroplane would lose its power.

But that even this estimate was wrong is indicated by the best performance on the list I have given. On Dec. 26, 1910, Mr. Archie Hoxsey, the brilliant American flyer who lost his life five days after creating this record, ascended to an altitude of 11,476 feet.

He was using one of the new type of Wright biplanes. These machines are smaller, lighter, and much speedier than were the original models. In high climbing they have revealed quite extraordinary powers, and they have also proved themselves to be extraordinarily efficient machines when piloted in high winds.

Second to the late Mr. Hoxsey comes M. Legagneux, who, after piloting a biplane for

ALTITUDE FLIGHTS

Altitude	Airman	Machine	Place	Date
11,476 feet	Hoxsey, A.	Wright (B.)	Los Angeles	26/12/10
10,746 "	Legagneux	Bleriot (M.)	Pau	9/12/10
9,714 "	Johnstone	Wright (B.)	Belmont Park	23/11/10
9,450 "	Drexel, A.	Bleriot (M.)	Philadelphia	31/10/10
9,174 "	Wynmalen	Farman (B.)	Mourmelon	1/10/10
8,790 "	Chavez	Bleriot (M.)	Issey, Paris	8/ 9/10
8,469 "	Morane	"	Havre	2/ 9/10
6,691 "	"	"	Havre	29/ 8/10
6,600 "	Drexel	"	Lanark	11/ 8/10
5,850 "	Chavez	"	Blackpool	3/ 8/10
5,500 "	Tych, T.	Farman (B.)	Brussels	1/ 8/10
4,658 "	Latham	Antoinette (M.)	Rheims	7/ 7/10
4,503 "	Brookins	Wright (B.)	Indianapolis	16/ 7/10
4,490 "	Olieslagers	Bleriot (M.)	Brussels	30/ 7/10
4,164 "	Paulhan	Farman (B)	Los Angeles	Jan. 12, 10

B. means biplane; M. means monoplane.

some time, became a monoplane flyer, and reached an altitude of 10,746 feet at Pau on the 9th of December, using for the flight a Bleriot monoplane.

More than one authority now expresses the view that one record after another will be established until a height of twenty thousand feet has been reached by aeroplane.

The next matter of record-making to concern us is in connection with the carrying of passengers. This problem is, of course, a very important one. It is a fact, however, that no very definite experiments have as yet been made in regard to the maximum of weight which it may be possible to lift into the air by means of aeroplane. Progress has been directed more to obtaining reliable machines to carry one person, and perhaps one passenger, than to evolving a regular passenger-carrying machine.

Important in this respect, naturally, is the regular two-seated machine which has been constructed by M. Bleriot. This passenger-carrying monoplane has been seen in regular flight at the aviation meetings of 1910. Equipped with a fifty horse-power engine, it has flown very well, proving itself to be extremely stable.

Now, with a one hundred horse-power engine at his disposal, M. Bleriot is experimenting with a monoplane which will have a seating accommodation for four people.

As a matter of fact, passenger-carrying is very largely a case of increased engine power. When engines more powerful than the one hundred horse-power model are obtainable, an increase in passenger-carrying will be attempted. In this connection, it is interesting to note that more than one well-qualified expert sees no reason why passenger-carrying should not be developed, fairly quickly, until it is possible to take a dozen people across country by means of the aeroplane.

I append here a list of twenty-seven of the most important passenger-carrying flights that have been made.

As things stand at present, and with engines of existing types it would be possible to build, to-day, an aeroplane to raise six people in the air. In this connection, it should be remembered that military tests, which are to take place in the autumn, require that a machine should be built capable of carrying four men as its normal "Crew."

A very interesting series of records concerns the passage of machines across the sea. Historic, in many cases, have been the flights made across the English Channel between Dover and Calais. Up to the present time the Channel has been crossed seven times by aeroplane. On two occasions, in the flights of Mr. Hubert Latham, machines have fallen into the water without seri-

Airman	Machine	Details	Date
Bleriot	Monoplane	Calais–Dover 21 miles	July 25th, 1909
Lesseps, Ct. de	Bleriot M.	Calais–Dover 21 miles	May 23rd, 1910
Rolls, Hon. C. S.	Wright B.	Calais–Dover and back to Dover 44 miles	June 5th, 1910
Moisant, J. B.	Bleriot M.	Calais–Tilmanstone, with passenger, 27 miles	Aug. 17th, 1910
Sopwith, T.	Howard Wright B.	Dover–Beaumont 21 miles (Beaumont 177 miles)	Dec. 18th, 1910
Cecil Grace	Short B.	Dover–Calais	Dec. 22nd, 1910
Rolls, C. S.	Wright B.	Nice–Cap Ferrat 32 miles	Apr. 23rd, 1910
Van der Born	Farman B.	Nice–Cap Ferrat 32 miles	Apr. 22nd, 1910
Loraine, R.	Farman B.	Blackpool–Liverpool	Aug. 10th, 1910
Loraine, R.	Farman B.	Holyhead–Howth Head (Ireland). 52 mls.	Sep. 11th, 1910
Curtiss, S. H.	Curtiss B.	Euclid Beach to Cedar Point. 60 miles across Lake Erie; and back to Euclid Beach. 120 miles both journeys	Aug. 31 and Sep. 1, 1910

[NOTE: Since this table was compiled, Lieut. Bague, a French officer, has flown 130 miles over sea, from Nice to a small island near Corsica.]

FLIGHTS WITH PASSENGERS

Airman	Date	Passengers (Including pilot)	Distance	Time
Breguet	Aug. 29th, 1910	5	Very short flight	. . . .
Sommer	April 20th, 1910	4	Very short flight	5m.
Farman, H.	Nov. 10th, 1910	4	12½ mls.	. . . .
Farman, H.	Aug. 2nd, 1910	3	. . . .	1h. 4 m.
Farman, H.	Mar. 5th, 1910	2	50 mls.	1h. 12m.
Mamet	July 9th, 1910	2	47 mls.	1h. 20m.
Harman, H.	Mar. 4th, 1910	2	14 mls.	16m.
Bleriot	June 12th, 1909	2	1,000 yds.	. . . .
Weyman	Sept. 7th, 1910	1	147½ mls.	. . . .
Kinet, D.	May 15th, 1910	1	. . . .	2h. 51m.
Fequant, Lieut.	June 9th, 1910	1	100 mls.	2h. 30m.
Kinet, D.	April 8th, 1910	1	102 mls.	2h. 19m.
Aubrun	July 9th, 1910	1	84 mls.	2h. 9m.
Aubrun	July 9th, 1910	1	84 mls.	2h. 9m.
Moisant	Aug. 16th, 1910	1	100 mls.	1h. 45m.
Wright, O.	Sept. 19th, 1909	1	. . . .	1h. 35m.
Graham, Glimour . . .	Sept. 13th, 1910	1	45 mls.	1h. 15m.
Farman, Maurice . . .	May 21st, 1910	1	50 mls.	. . . .
Wright, O.	July 27th, 1909	1	. . . .	1h. 12m.
Farman, H.	Nov. 2nd, 1909	1	. . . .	1h. 7m.
Paulhan	Jan. 19th, 1910	1	22 mls.	33m.
Moisant	Aug. 17th, 1910	1	21 mls.	38m.
Dutrieu, Mlle.	Sept. 2nd, 1910	1	20 mls.	. . . .
Wynmalen	Oct. 16–17, 1910	1	300 mls.	15h.
Maillois, Lieut.	Nov. 26th, 1910	1	127 mls.	3h. 15m.
Camerann, Lieut. . . .	Dec. 21st, 1910	1	145 mls.	4h.
Laurens, M.	Dec. 21st, 1910	1	62½ mls.	1h. 16m.

[NOTE: Since this table was compiled, M. Sommer has been able to lift 12 passengers on his biplane.]

ous injury to the pilot, but with disastrous results to themselves — the aeroplanes being wrecked in each case. Regarding a third attempt, that of Mr. Cecil Grace — after he had flown from Dover to Calais, and was returning to Dover — the sea claimed a victim. No sadder calamity than this is on record. I append a list of eleven of the principal flights that have been made over water.

Very illuminating, as showing the progress made in cross-country flying, is the list that has been prepared for me showing the chief aerial journeys in stages which have been made up to the present time.

The most important figures refer to the Circuit of the Eastern part of France made in the summer of 1910, by a number of airmen who were seeking to win a valuable prize offered by the great Paris daily paper, the *Matin*.

The table in this case more or less explains itself. It shows how extraordinarily well MM. Leblanc and Aubrun, both of whom were flying Bleriot monoplanes, were able to maintain their average, and escape disaster when landing at the various stages. Altogether, in this remarkable air race, a distance of 497 miles was flown across-country by the two pilots who competed the total course. The table is appended.

Bielovucie's journey from Paris to Bordeaux, one of the most interesting voyages yet under-

taken, was done with the idea of showing that the aeroplane can already vie with the train. The airman was engaged to fly at Bordeaux. Instead of packing up his machine and sending it by train, he decided to fly the distance, which was three hundred and fifty miles. He did it, without accident, in a total flying time of about 7½ hours, the journey actually occupying him three days.

Another interesting feature of the table is Farman and Paulhan's combined journey. These airmen did a very instructive cross-country trip of about two hundred miles, taking it in turns to steer the machine. This was another illustration, and a very striking one, of the practicability of the aeroplane.

CROSS-COUNTRY FLIGHTS IN STAGES

"Matin" Prize. Circuit d'Est

1st stage. Aug. 7th, 1910. Issy-les-Moulineaux–Troyes. 84½ miles

Leblanc	1h. 32m. 20s.	
Aubrun	1h. 37m. 35s.	
Lindpainter	2h. 25s.	
Legagneux	3h. 59m. 35s.	

2nd stage. Aug. 9th, 1910. Troyes–Nancy. 103 miles

Leblanc	2h. 19m. 11s.	3h. 52m. 9s.
Aubrun	2h. 27m. 40s.	4h. 5m. 15s.
Legagneux	5h. 31m. 26s.	9h. 31m. 1s.

3rd stage. Aug. 11th, 1910. Nancy–Mezieres–Charleville. 100 miles

Leblanc	2h. 6m. 20s.	5h. 28m. 29s.
Aubrun	3h. 41m. 27s.	7h. 47m. 42s.

4th stage. Aug. 13th, 1910. Mezieres–Charleville–Douai. 84½ miles

Leblanc	3h. 3m.	9h. 1m. 36s.
Aubrun	2h. 20m.	10h. 6m. 50s.

5th stage. Aug. 15th, 1910. Douai–Amiens. 50 miles.

Leblanc	1h. 8m.	10h. 14m. 54s.
Aubrun	1h. 25m.	11h. 36m. 6s.

6th stage. Aug. 15th, 1910. Amiens–Issy-les-Moulineaux. 75 miles

Leblanc	1h. 53m. 28s.	12h. 8m. 22s.
Aubrun	2h. 3m.	13h. 28m. 11s.

Total distance flown: 497 miles.

Maurice Farman's Paris–Bordeaux flight

1st stage	Buc–Chartres	53m.	42 miles	9/12/09
2nd stage	Chartres–Orleans	50m.	42 miles	31/12/09

H. Farman and Paulhan's combined journey

H. Farman	Etampes–Chevilly	50 miles	Apr. 17th, 1910
L. Paulhan	Chevilly–Arcis-sur-Aube	110 miles	Apr. 18th, 1910
L. Paulhan	Arcis-sur-Aube–Chalons	40 miles	Apr. 19th, 1910

Total distance about 200 miles in about 5 hours

Bielovucie's Paris to Bordeaux journey

1st stage	Issy–Orleans	78 miles	1h. 15m.	1/8/10
2nd stage	Orleans–Chatellarault–Angoulême	197 miles		2/8/10
3rd stage	Angoulême–Bordeaux	75 miles		3/8/10

Total distance of flight: 350 miles. Time about 7½ hours

CHAPTER XI

THE AEROPLANE DEATH ROLL AND ANALYSIS OF MANY FATAL ACCIDENTS

In this chapter, I shall deal, in as full a way as possible, with the aeroplane accidents which have caused the deaths either of the pilots or of passengers.

I have had very carefully prepared a list of the fatalities up to the time of writing. I shall endeavor, where possible, to analyze the causes of these accidents.

My material in doing so will be the accounts which have been given of the catastrophes by people who have seen them. The objection can, no doubt, be raised that these stories of eye-witnesses have, in some cases, been confusing. But this material is all we have, so we must make the best of it.

I will now append the list of the forty-one fatalities which have marred the progress of flying from the year 1896 to April 1, 1911.

After the reader has scanned this list he will be better able to appreciate the comments which I shall make upon it. The death roll is appended.

First one finds the date of the accident, then the name of the pilot, followed by the place where the catastrophe took place, and, when known, the type of machine that the airman was using.

The first two victims, as given on our list, were the very early pioneers of flying. Both Lilienthal and Pilcher were ardent advocates of gliding. Both of them devoted their lives to discovering the plane construction which gave the greatest "lift," and also the arrangement of planes which provided the greatest stability in flight.

Lilienthal was the first martyr. After carrying out a very great number of experiments with a gliding machine of biplane form, Lilienthal fell to the ground while making a glide, and was killed. The exact cause of the accident is not known, but it is fairly clear that he lost control of the glider.

Lilienthal's work was of extreme value to those who, following him, had the petrol motor at their service, and were able to design a machine that was power driven.

All Lilienthal's experiments of course, and those of Pilcher as well, were conducted with small machines in which no motor was fixed. As I have explained in another portion of this book, their method was to proceed with their machines to the top of a hill and then glide down the side of it.

Lilienthal made a great number of useful dis-

AEROPLANE FATALITIES

Date		Airman	Place	Machine
1896	Aug. 10th	Lilienthal	Lichterfield	Biplane glider
1899	Sept. 30th	Pilcher, P. S.	Stanford Park	Monoplane glider
1908	Sept. 17th	Selfridge, Lieut.	Fort Myer	Wright biplane
1909	Sept. 7th	Lefebre, E.	Juvisy	Wright biplane
	Sept. 22nd	Ferber, Capt.	Boulogne	Voisin biplane
	Dec. 6th	Fernandez, Señor	Nice	Fernandez biplane
1910	Jan. 4th	Delagrange, L.	Pau	Bleriot mono.
	April 2nd	Le Blon, H.	San Sebastian	Bleriot mono.
	May 13th	Hauvette-Michelin	Lyons	Antoinette mono.
	June 18th	Robl, T.	Stettin	Farman biplane
	July 3rd	Wachter, C.	Rheims	Antoinette mono.
	July 12th	Rolls, Hon. C. S.	Bournemouth	Wright biplane
	July 13th	Kinet, D.	Ghent	Farman biplane
	Aug. 3rd	Kinet, N.	Stockel	Farman biplane
	Aug. 20th	Pasqua, Lieut. V.	Rome (near)	Farman biplane
	Aug. 27th	Massdyck, C. van	Arnheim	Sommer biplane
	Sept. 25th	Poillet, E.	Chartres	Savory biplane
	Sept. 27th	Chavez, G.	Domodossola	Bleriot mono.

[Table continued on reverse of page.]

	Sept. 28th	Plochmann, Herr	Hausheim	Aviatik biplane
	Oct. 1st	Haas, Herr	Wellen	Wright biplane
	Oct. 7th	Matsievich, Capt.	St. Petersburg	Farman biplane
	Oct. 23rd	Madiot, Capt.	Douai	Breguet biplane
	Oct. 25th	Mente, Lieut.	Magdeburg	Wright biplane
	Oct. 26th	Blanchard	Issy-le-Moulineaux	Bleriot mono.
	Oct. 27th	Saglietti, Lieut.	Centocelle	Sommer biplane
	Nov. 17th	Johnstone, R.	Denver, Colorado	Wright biplane
	Dec. 3rd	Cammarota (and passenger Castellani)	Centocelle	Farman biplane
	Dec. 22nd	Grace, C.	North Sea ?	Short Wright biplane
	Dec. 28th	Picollo, Signor	San Paulo	Monoplane
	Dec. 28th	Laffont (and passenger Polo)	Issy-le-Moulineaux	Antoinette mono.
	Dec. 30th	Caumont, Lieut.	St. Cyr	Nieuport mono.
	Dec. 31st	Moisant, J. B.	New Orleans	Bleriot mono.
	Dec. 31st	Hoxsey, A.	Los Angeles	Wright biplane
1911	Jan. 9th	Roussijan, M.	Belgrade	Monoplane
	Feb. 6th	Stein, Lieut.	Doberitz	Farman biplane.
	Feb. 9th	Noel (2 passenger Le Torre)	Douzy	Sommer biplane.
	March 29th	Signor Cei	Paris	Caudron biplane.

coveries regarding the way in which the up and down movement and sideway control of an aeroplane could be affected.

Pilcher, who followed him as one of the victims of aerial research, devoted most of his attention to gliding machines on the single surface or monoplane principle. His pioneer work, like that of Lilienthal's, provided later experimenters with a very great amount of valuable data.

Pilcher's death, as did that of Lilienthal, occurred while he was making a glide, through the sudden plunging of the machine to earth. Both these men were unfortunate in being killed. It was through their courage in attempting work with unknown and untried machines that disaster came to them.

Nowadays, gliding is an extremely safe and simple sport. It owes its safety to the fact that only gliding machines of an accepted form and of a well-proved stability are employed.

It is comforting to think, when one refers to the deaths of Lilienthal and Pilcher, that their devotion to the science of airmanship, and the sacrifice of their lives, was not in vain. They have given us facts that have been of the utmost use.

Working as they did before a petrol motor was ready to be put in a flying machine, they did a vast amount of preliminary work in determining the most suitable types of plane surfaces and controls.

The first victim of a power-driven aeroplane was Lieutenant Selfridge, of the American army. Ascending at Fort Myer on Sept. 17, 1908, with Mr. Orville Wright, in a Wright biplane, he met his death in an accident which has not yet been satisfactorily explained. The machine was apparently flying quite well when, as is so often explained by spectators who are present at a disaster — " something happened." The machine was flying at a fair height.

Mr. Wright lost control of it. It fell very heavily. In addition to the fact that Lieutenant Selfridge was killed, Mr. Wright had a thigh broken, and sustained a very serious shock. One of the explanations that I have heard advanced was that one of the chains which drove the propellers broke while in flight. Another theory is that the control wires gave way somewhere.

But the machine was too great a wreck for any theory to be proved. This is a point that needs emphasizing. In the majority of really bad accidents a machine is very badly broken up. The result is that it is extremely difficult, and in many cases quite impossible, to determine whether any portion of the apparatus gave way in the air.

The death of Lieutenant Selfridge caused a great gloom over the then small but enthusiastic world of aviation. Up to that point, a good many flights, although brief, had been made without accident, and it came as a great shock to many

people to realize that this element of danger lurked in flying.

The death of Lefevre, who was the pilot of a Wright biplane, and the next victim on the list of airmen killed, occurred soon after the great Rheims flying meeting of 1909. At this meeting Lefevre had flown his biplane with a skill that aroused the greatest enthusiasm.

One evening, particularly, he carried out daring evolutions near the grand-stand which made the people cheer and cheer again. His tricks consisted in extraordinary rapid turns, with his aeroplane banked up at the high angle which is possible with an experienced pilot of the Wright machine. He also made his aeroplane rise and fall very rapidly.

These feats rather gave Lefevre the reputation of being an over-daring pilot. But, as a matter of fact, I am told that he exercised a great deal of judgment when flying. His death was certainly not due to any piece of recklessness.

He was flying a new Wright biplane at the Juvisy aerodrome on Sept. 7, 1909. It had been bought by a customer, and Lefevre was ascending to see that it was in good running order. Soon after he had started his flight, and while he was quite close to the ground, the machine suddenly dipped down forwards and crashed to earth. Lefevre was killed almost instantaneously. In this case, the aeroplane was so hopelessly wrecked

that any explanation of the disaster was not forthcoming.

But it was pretty clear that the pilot was not to blame for the accident. What was generally assumed, I think, was that the gear controlling the elevating plane broke, and that the machine became, in a second, beyond control.

Captain Ferber, of the French Army, who met with his death on Sept. 22, 1909, was a great worker and a great thinker in the cause of airmanship.

His experiments had been conducted on a very definite and useful scale. He had devoted himself, especially, to the question of the efficiency of aeroplane propellers. One device of his that I remember very well was the fixing up of an aeroplane propeller upon a sort of miniature motor-car. He then made the air-propeller draw the car along — thus testing its "pull" in a very practical way.

Captain Ferber began flying upon a Voisin biplane. At the Rheims meeting of 1909 he was a competitor in a good many events, adopting the "flying name" of De Rue.

Soon after the conclusion of the Rheims carnival Captain Ferber was induced to visit Boulogne in order to take part in a demonstration of flying which had been arranged there. His death was caused in a very curious way. It illustrated the fact, that a man might meet with very grave dis-

aster in an aeroplane even when moving along quite close to the ground. Ferber was flying in the evening, and was attempting to make a turn while very close to the ground.

One of the wing-tips of his machine touched the ground, and the machine turned over. The shock was so violent that the aeroplane was badly wrecked. Unfortunately for Ferber, the engine, which was jerked out of its bed, fell upon him.

When picked up he did not appear to be very badly injured. But he died quite suddenly, soon after having been extricated from his machine, owing to the internal injuries which he had received.

Ferber's death indicated the need for a pilot to keep well away from the ground when making a turn. It showed, too, that there was a danger, when a machine was wrecked, of the engine falling upon the pilot. In the Voisin, as in many other machines, the pilot in those days — and to a great extent the same remark applies to construction now — sat immediately in front of his motor.

Another flyer who figured in the programme at the first Rheims meeting, Señor Fernandez, a Spanish airman, met his death on Dec. 6, 1909. His was the next fatal accident following that of Ferber. Señor Fernandez did not fly at all at the Rheims meeting. His biplane, which was one of his own construction, and rather resembled the famous Curtiss machine, was not ready.

Afterwards, at Nice, he managed to get it into flying trim, and made several good flights. All the accounts of his death indicate that some portion of his machine gave way while in the air. The criticism had, in fact, been leveled against it previously that it was not sufficiently strong in a good many respects. Poor Fernandez fell from a considerable height and was instantly killed.

Now we come to the death of Delagrange, one of the great pioneers of aviation, and the man who followed Farman as an early pilot of the Voisin biplane. After a number of flights, both in France and in England, Delagrange was experimenting on Jan. 4, 1910, with a Bleriot monoplane, fitted with a 50 horse-power Gnome motor. This engine was of much greater power than the Anzani one which had been previously fitted to Bleriot machines.

Delagrange had tried this machine for the first time at the Doncaster aviation meeting, where he attained a speed of 50 miles an hour. Ascending at Pau, on the day of his death, in a rather gusty wind, he was flying near the sheds, when, in the words of one who saw the accident, "the machine seemed to fold up suddenly and come to the ground." Delagrange was killed, and the machine was fearfully wrecked.

Regarding the cause of the accident, accounts have varied perplexingly. One explanation was that a strengthening rod, fixed between the

planes, had been accidentally left out of the machine before the flight. Another was that the aeroplane was not sufficiently strong to stand the strain of being forced through the air so fast by the Gnome motor. It was clear, I think, that one of the wings collapsed. My view, although given tentatively, is that the machine was struck by an unusually heavy gust, and that the wing that collapsed would not stand the shock. That any great blame attached to any one in connection with the accident I do not think. The machine had flown well before, and it had been strengthened to withstand its extra power.

It is curious that the next death chronicled, that of Leblon, should follow immediately after the fatal accident to Delagrange. Leblon was Delagrange's pupil, and also one of his friends. His fall into the sea at San Sebastian on April 2, 1910, will be described by me in the chapter I shall devote to this exceedingly clever pilot. His was an altogether mysterious accident. The cause of his death was attributed by doctors to the fact that he had some sort of fit while flying too soon after lunch, and so lost control of his machine. As reasons for this argument were brought forward on medical grounds, I do not see any reason why it should not be accepted, although some attribute the accident to engine failure.

M. Hauvette-Michelin, who comes next on the death-roll, was a very young airman, who had

taken up flying quite for the love of the sport. He was, at the time of his fatal accident, learning to pilot an Antoinette monoplane.

His death was a very remarkable one. The pilot was actually killed while his machine was on the ground. M. Hauvette-Michelin had had his monoplane sent to the flying meeting at Lyons. Here, in the evening, after flying was over for the day, he was practicing.

He was running his machine along the ground at the time of the accident. Marking the course were several built-up wooden pylons or mark-towers. Into one of these the pilot ran. The collision was so serious that the pylon fell over on the pilot, and injured him so much that he died.

Herr T. Robl, a well-known racing motorcyclist, who had taken up aviation, was the next victim. He was performing at Stettin on a Farman biplane on June 18, 1910.

It appears, from accounts which have been received, that a large crowd had come together to witness flying, and that the day had been blank on account of a dangerous wind which was blowing.

In the evening, so as not to disappoint the crowd entirely, Robl came out. Whether he did so knowing the risk that he would run or not, I am not sure. At any rate, he seems to have attempted a flight in a wind that was dangerous, although the exact velocity is not recorded.

He flew for a little while, and then, when at a good height, his machine seems to have been overturned by a gust and the airman was killed. His death aroused at the time, and very rightly, a storm of indignation. It was held to be an illustration of the danger of demanding a flight under bad conditions just because a crowd of people had paid their money to see a man fly.

As a writer in the London *Daily Mail* remarked: " Even after having paid a shilling, one is not entitled to see a man killed." The public is not, I suppose, very much to blame in such a case. They feel that they want their money's worth, and they are not judges as to whether conditions are suitable for flying or not. But a grave responsibility rests with the organizers of any meeting who suggest to a man that he should go out and fly in order to please the crowd when a dangerously gusty wind is blowing.

We go to the second carnival of flying at Rheims before we come to the death of the next airman. This was M. C. Wachter. He was a pilot of the Antoinette monoplane. Becoming a very proficient manipulator of this machine M. Wachter had been, for some time prior to his death, an instructor of the flying school operated by the Antoinette Company at Chalons.

On the day of his death, July 3, 1910, the pilot had been flying very brilliantly. Going out for the long-distance contest, he had flown through

a storm of rain rather than descend. Soon after he started another flight. He was about 500 feet high when it was seen by those watching from the sheds that he was in trouble. To the observers, even those specially able to judge, all that happened, apparently, was that one of the wings of his machine folded up.

The machine fell at a dreadful speed, and was reduced to a mass of wreckage. Wachter was killed on the spot. Although the wreckage of the machine was examined afterwards with the greatest care no theory could be advanced from it to account for the accident.

One expert who was present told me that he thought the passing of the machine through the rain storm, which would have soaked its canvas, might have accounted for the collapse of a wing, had the pilot suddenly turned, and made a very abrupt *vol plané*.

Apart from this, the accident remained more or less of a mystery. But one point is clear. The catastrophe can be put down as one of those caused, not by a mistake on the part of the pilot, but by the giving way of some portion of the planes, or mechanism of a machine.

The next tragedy of the air with which I have to deal is probably the saddest of all, because it robbed England of one of the first and most celebrated of her pioneers. I refer to the death, at the Bournemouth aviation meeting, of the Hon. C. S. Rolls.

Mr. Rolls, although he had piloted a Sommer biplane in a few flights, and had actually ordered, just before his death a Farman biplane, had done all his flying work upon a Wright biplane.

The first machines that he used were constructed for him by Mr. Horace Short, the aeronautical engineer of the Royal Aero Club.

But, at Bournemouth, Mr. Rolls was trying a Wright biplane of a type built for him in France. Fitted to the machine on which he met his death was a new single surface tail-plane, which was operated in conjunction with the front elevators and was fitted with the idea of making the machine fly more steadily.

In the flight which ended fatally Mr. Rolls was competing in a prize for the competitor who landed nearest to a given spot. After passing over the grand stand he was flying against a moderate breeze, and was descending with a view to landing near the mark — a circle outlined in whitewash in the aerodrome.

At the time of the disaster, Mr. Rolls was from sixty to eighty feet high. The machine was descending at a rather sharp angle. It appeared to us as though the pilot, realizing that he was descending at rather too steep an angle, attempted to "straighten up" his machine a little too abruptly.

There was a noise at the rear of the machine. A fragment of wood fell away from it. The next

instant, to those who were watching, it was seen that the tail-plane of the machine had broken adrift. Exactly what happened after this is not absolutely clear. It is a fact, however, that the tail of the machine became entangled with the propellers, and that the aircraft made a steep dart downwards to the ground.

It struck the aerodrome very heavily, and was badly wrecked. Mr. Rolls, thrown violently from his driving seat, sustained such severe injuries that he died a moment or so after he had been extricated from the machine. It is clear, in connection with this accident, that it may be classed with those which have been caused by the giving way of some portion of an aeroplane while in flight.

Daniel Kinet, the pilot who comes next in the roll of those who have sacrificed their lives in the cause of aviation, was the pilot of a Farman biplane. On the day of his death, July 13, 1910, he was on a cross-country flight from Ghent to Liège.

The weather conditions were not unfavorable. The airman had completed a portion of his journey without incident. Suddenly, however, his propeller was seen to cease to revolve. This indicated, of course, that his engine had failed him. The machine after the stoppage of the motor, came down to earth. Kinet landed safely in a field, but ran into a tree. The aeroplane was overturned, and Kinet fatally injured.

In the month following Daniel Kinet's death, Nicholas Kinet, flying a similar type of machine — a Farman biplane — came to grief at Stockel in a very startling way. He was flying in a high wind. Suddenly his machine gave a lurch in the air. Then it slipped sideways, and came crashing to the ground. Kinet was killed by the fall. Undoubtedly his death was due to flying in too high a wind.

A young Cavalry officer of the Italian Army, Lieut. V. Pasqua, was the next pilot to meet his death while flying. Lieutenant Pasqua had learned to fly a Farman biplane. On Aug. 20, 1910, he ascended from the Centocelle aerodrome, near Rome, for a cross-country flight.

Accompanying him, on another biplane, was a fellow-officer, Lieutenant Savoia. The latter's petrol supply ran out after a short time, and he made a safe descent. Lieutenant Pasqua flew on for some time longer. Then, when he was about 300 feet high, his engine stopped. Probably, in his case also, his petrol supply may have become exhausted.

In this case, from what I have been told, it would seem that the cause of the airman's death was his failure to make a glide after the stoppage of his engine.

The performance of a *vol plané* is, as I describe elsewhere, by no means easy. A good deal of practice is required before one can point one's

machine downwards and glide safely to the ground after engine stoppage, or after voluntarily cutting off one's power. Lieutenant Pasqua appears to have practically stood still in the air after his engine failed him. Then the machine fell awkwardly to the ground and he was killed.

Regarding the death of Clement van Maasdyck, a twenty-five-year-old airman, who was killed while flying near Arnheim, very little satisfactory evidence is forthcoming. Van Maasdyck was piloting a Sommer biplane. He had attained a height of about 150 feet. Suddenly, in the words of an onlooker, "his machine stopped and fell like a stone." There seems little doubt but that the airman "banked" over his machine too sharply, in making a turn, and that it "sideslipped" to the ground. A noteworthy feature of this accident was that the engine of the machine, thrown from its position, struck the unfortunate airman, and was the cause of his death. A similar thing happened, it will be remembered, in the case of Captain Ferber.

M. Edouard Poillet, killed at Chartres on Sept. 25, 1910, had been a sporting journalist before he became the pilot of a Savory biplane. On the day that he met with disaster M. Poillet had been making a number of flights with passengers. On the journey which ended in a fatal accident he was carrying with him a pupil by the name of Bartiot.

The machine was seen to tilt over sharply to one side, and the pilot was not apparently able to gain control of it again — seeing that he was flying low — before it struck the ground with a crash. The unfortunate pilot had his spine broken. His passenger, however, escaped with nothing more serious than a few bruises.

Naturally, in a case like this, where a passenger escaped uninjured from an accident, he was asked to give his version of how the catastrophe occurred. M. Bartiot declared his belief that the aeroplane had been struck by a sudden gust of wind, which the pilot had been unable to overcome.

World-wide regret was expressed when the death was announced of Chavez, the Peruvian airman, who, after piloting a Bleriot monoplane in all sorts of contests with the greatest distinction, met his death in an attempt to fly over the Alps. The great part of his wonderful, and perilous, undertaking had been achieved when he came planing down at Domodossola. To everybody's astonishment, instead of steadying his machine, and making it land on an even keel, the pilot apparently allowed his craft to strike the ground at a steep angle.

In the fall, Chavez sustained serious injuries, including the breaking of his legs. A few days afterwards, when he appeared to be recovering, he died suddenly from the shock of his injuries.

Of explanations of this disaster there have been many. Some people declare that one of the wings of the monoplane collapsed. Others aver that the pilot was caught by a gust of wind just at the moment that he was preparing to make a landing.

A person well acquainted with aviation, who was present when Chavez fell, has told me his version of the accident. He believes that the airman became numbed with the cold in his descent from an altitude of seven thousand feet. He thinks that Chavez had lost the use of his hands, and was not able to make the necessary movement to "straighten up his monoplane" just before contact with the ground.

Personally, thinking this theory better than any other, I am inclined to accept it. That pilots should suffer from intense cold when descending from a great height is not unlikely. I remember that, at Lanark, after making a world's record of six thousand odd feet, Mr. Drexel felt the cold so badly while he was coming down that one hand became numbed and the other almost useless before he was able to make a landing.

Had Chavez been so numbed with the cold this would have accounted for his failing to bring his machine level before touching the ground. He might even have suffered from some sort of an attack of faintness after his swift rush over the Alps at such a great height. But this is one of the cases in which one can never be sure exactly what did happen.

From the death of Chavez we turn to that of Herr Ernst Plochmann, which occurred at Hausheim on Sept. 28, 1910, while piloting an Aviatik Biplane. This machine is not anything remarkable in the way of an aeroplane, but merely represents the German title that is given to a machine of the Farman type.

Herr Plochmann's accident is completely enshrouded in mystery. Nobody, not even those who saw the fall, knew exactly what happened. At the time of the disaster he was flying about one hundred and fifty feet high. Suddenly, without any warning, the machine was seen to fall, and the airman was killed. The biplane was so completely wrecked that it was not possible to deduce anything from it to account for the airman's sudden loss of control. This accident can, indeed, only be regarded as a mystery.

Regarding the death of Herr Haas, another German airman, who met with a fatal accident on Oct. 1, 1910, a more definite story is to be told. Herr Haas was a flyer on the Wright machine, and a man who had attained great skill in handling this type of aircraft. On the day that he met with the disaster, he was essaying a cross-country flight. At a height of five hundred feet, his propellers were seen to stop. It was discovered, afterwards, that one of

the chains actuating his propellers had broken. Instead of making a *vol plané,* he seemed to lose control of the machine, and fell. The aeroplane was utterly wrecked, and every bone in the unfortunate pilot's body was broken. This accident must, I think, be attributed to engine trouble — although the pilot ought to have been able, had something quite unexpected not have happened, to plane safely to earth.

Captain Matsievich, a Russian airman who had learned to fly a Farman biplane, comes next in the list of victims of the air. Captain Matsievich was flying at St. Petersburg on Oct. 7, 1910, when he came to grief. Expert testimony gives it that some wire stays between the mainplanes and the tail of his machine gave way.

The broken wires appear to have become entangled with the propeller of the machine. At the time, the airman was at a height which was estimated to be at least 1,500 feet. After the breaking of the propeller, caused by contact with the wires, he apparently lost all control of his machine, and came to earth with fearful force. The airman sustained fatal injuries. This disaster must be attributed, without doubt, to the breakage of a portion of the machine.

A French military airman, who was making his first flight alone, Captain Madiot, was killed at Douai on Oct. 23, 1910. His accident was a very confusing one. The captain was making

a turn over the aerodrome at a height of about three hundred feet when eye-witnesses declare that they saw the machine collapse.

Other people, however, state that in their opinion the pilot made a turn at too steep an angle, and that his machine slid down through the air. Others, again, affirm that the captain was taken suddenly ill, while flying, and thus lost control of his aeroplane. Whatever may have been the cause, the fact remains that the machine came to earth so heavily that the pilot lost his life.

It is interesting to record that an examination was made afterwards of the machine. Every controlling wire was found to be intact. Therefore, the accident could not have been due to the breaking of any one of his control wires. A portion of the machine may, of course, have collapsed in flight, or he may have made a false move.

Personally I think, in a case like this, the cause of an accident should be written down as being unknown. It is not fair to blame either the man or the machine when the evidence upon which one does so is so confusing.

Another military airman, Lieutenant Mente, an officer of the Prussian Army, was the next victim of the air. He was killed at Magdeburg on Oct. 25, 1910. Here, again, save for the melancholy fact that the pilot's neck was broken,

there is no testimony as to the manner in which he met his death.

He was at an altitude of over two hundred feet when the machine apparently turned over, and fell sheer to the ground. This must be written off as an accident with an unknown cause — although, no doubt, those who wish to emphasize the need for stronger construction in aeroplanes will say that it was probably due to the breaking of some vital part of his machine.

M. Fernand Blanchard, a monoplane pilot, met his death on the following day — Oct. 26, 1910 — by a fall from a height of only a 100 feet while flying at Issy-les-Moulineaux, close to Paris. M. Blanchard was making a descent, when it appeared that something went wrong with his machine. It is probable, from the testimony of those who were present, that a control wire gave way. At any rate, the monoplane he was flying gave a lurch sideways and crashed awkwardly to the ground, the pilot being dreadfully injured. In this case, I think, one can write down the cause of the accident as being due to a failure of a portion of the pilot's machine.

In all these accidents, there is an element of doubt. Unless actual proof can be obtained from an examination of an aeroplane after a catastrophe, the only means of estimating what happens is from the explanation of those who saw the machine just before it fell.

Lieutenant Saglietti, an Italian military pilot, was the next flyer who came fatally to grief. He was experimenting at Centecelle on Oct. 27, 1910, with a Sommer biplane. He had done a number of good flights, and was circling well above the aerodrome, when his machine was seen to pitch forward and come to the ground. There is little doubt, from the words of those who saw the accident, that the control wires leading to the elevating plane of the machine broke, or failed to act in some way. One or two people describe how they saw the airman working at his lever as though striving to make it act properly. The officer's fall was so serious that he died almost at once. Quite clearly, I think, this accident may be attributed to a failure on the part of the machine, and not on the part of the man.

Mr. Ralph Johnstone, an American airman of much experience, and of the very greatest skill, is next in the death roll. From being an expert trick cyclist on the music-hall stage, Mr. Johnstone took up aviation with enthusiasm, and soon became an astonishingly clever pilot of the Wright biplane. His skill became so great, after a time, that he attempted many surprising feats while in the air. His death took place at Denver, Colorado, where he was giving a demonstration. While performing a startling spiral glide to the earth, a specialty which the pilot

had made his own, it was apparent to those observing him that some portion of his machine had collapsed. Although he appeared to be striving to regain control of his machine, he failed to do so, and lost his life in a fall which completely wrecked the aeroplane. Although this accident must be placed in the list of those caused by the breaking of some portion of a machine, it is only fair to the aeroplane to add that it appears clear that the pilot was subjecting it to an undue strain at the time it collapsed.

A double fatality next shocked the world of aviation. A pilot, and the unfortunate passenger he was carrying, were both killed at Centocelle. The victims were named Cammarota and Castellani, both military engineers. They were flying on a Farman biplane. Except that the machine fell from a considerable altitude little definite information is to hand.

It seems fairly clear, however, that the pilot was making his machine turn at the time of the disaster. He was seen to be making this evolution sharply. Suddenly the machine fell. It is thought that some part of it collapsed.

An irreparable loss to British airmanship was involved in the next disaster, — that by which Mr. Cecil Grace, one of the most prominent pilots in England, lost his life on Dec. 22, 1910. Mr. Grace was flying back from Calais to Dover

in the afternoon, after having made a crossing of the Channel to France earlier in the day. He had meant to keep on into France in an attempt to win the De Forest £4,000 prize, but an adverse wind caused him to descend, with the idea of regaining his starting-point, and so being able to make a fresh attempt the next day. When he left the French coast, to fly to Dover, there was no mist.

In fact, the sun was shining. But somewhere — probably about half way across channel — Mr. Grace ran into a thick sea mist. He may have been steering by compass, or he may not. This will never be known. What he did, however, without doubt, was to turn north instead of northwest after entering the fog.

Beyond a momentary glimpse of him, which was obtained by the men of the East Goodwin lightship, he disappeared completely. It seems to those who have studied the sad problem, that he must have gone right out into the North Sea and flown about in bewilderment until his engine failed him and his machine fell into the water. Afterwards, without doubt, poor Mr. Grace must have been drowned.

This accident cannot very well be put under any ordinary classification as to its cause.

Starting in clear weather, and running into fog, the airman was the victim of misfortune. That it was an error on his part to lose his

way in the fog cannot be said. Therefore, for the sake of placing it under some heading, I shall set this disaster as being from an unknown cause.

Signor Picolli, an Italian airman who was flying on a monoplane at San Paulo, on Dec. 28, 1910, was the next pilot to lose his life. It is clear, from the reports that came to hand, that the flyer was tempted out in too high a wind. While quite near the ground his monoplane was caught in a gust and turned over. This accident is to be attributed to flying in too high a wind.

The famous ground at Issy-les-Moulineaux was the scene of the next aerial disaster, in which an Antoinette monoplane, and two men, were concerned. With the idea of starting on a long cross-country flight M. Laffont, one of the chief of the pilots of the Antoinette school, and the Marquis di Pola, were making a preliminary trial. The wind was rather high, but not unusually so for an Antoinette.

When about 500 feet high the machine appeared to rock very violently, as though struck by a sudden gust. Then, so far as could be seen, one of the wings gave way. The machine came rushing to the ground, and both its occupants were killed. Here, it is quite certain, the accident was caused by the breaking of the machine.

Lieutenant Caumont, a French Army pilot who was practicing with a Nieuport monoplane on Dec. 30, 1910, was killed at St. Cyr. In this case, there is a conflict of opinion. Some people say that the pilot had trouble with the rudder of his machine, and lost control of his craft when nearing the ground. Others attribute the accident to an error of judgment purely.

Although he did not fall from any great height, the pilot was so dreadfully injured that he died in hospital almost immediately after the accident. In order that I may do neither the pilot nor the machine an injustice, I shall place this accident as being one due to unknown causes.

Mr. John B. Moisant, an American airman, with whom I was flying at the Belmont Park aviation meeting, was killed on Dec. 31, 1910, as was also Mr. Archie Hoxsey, another very well-known American pilot. The last week in December was, indeed, an extraordinarily black one so far as aviation was concerned.

Mr. Moisant had been, from the first, a man who believed in flying in winds. Some of his ascents in America were carried out under conditions that rendered them very perilous.

On the day of his death he was flying at New Orleans on a Bleriot monoplane. The wind, from what I can hear, was bad. While making a turn, the aeroplane was seen to swerve side-

ways and fall. There is little doubt, I think, but that Moisant's death was due to flying in a wind that was too high.

Hoxsey, a world-famed high flyer, who was killed at Los Angeles, was piloting a Wright biplane. He was three hundred feet high, and making a descent, when a gust of wind seemed to get under one side of the machine and turn it over. Mr. Hubert Latham, who was present at the time, and saw Hoxsey's fall, attributed it to the airman having come into a " air hole " while descending. By this he meant that the machine had, in passing from one wind gust into another, met a sort of gap in which the pressure under the planes was temporarily reduced. As to the cause of the accident, although I think the pilot may have brought about disaster by straining his machine, it must still, I think, be put down as one of those occasioned by the breakage of part of the aeroplane.

M. Rusjan was killed at Belgrade on Jan. 9, 1911. The type of machine he was flying was a monoplane. The case of the accident was clear. His propeller, without doubt, burst in mid-air, and the pilot either lost control of his machine afterwards, or the propeller, in coming off, must have damaged some part of the machine.

At any rate, the result was disastrous. The aeroplane fell to the earth from a good height,

and was wrecked, the pilot being killed. The accident must be attributed to what I have classified as "breakage of machine."

Lieut. Stein, who was killed on Feb. 6, 1911, lost control of his biplane when descending from a flight.

Noel, who, with his passenger M. Le Torre, was killed on February 9, was making too steep a *vol plané,* with the result that his machine struck the ground with great force.

The last victim, Signor Cei, was flying 2,000 feet high, over a suburb of Paris, when his biplane was seen to fall. The cause of the accident is unknown.

CHAPTER XII

THE SAFETY OF FLYING

In the thirty-five accidents with power-driven aeroplanes, which have caused the fatalities I have described in the previous chapters, it is very instructive to endeavor to find out exactly what the principal causes of these disasters were. In the chapter of my book which follows I shall deal with this phase of the subject. It is an unusually important one, seeing that makers of aeroplanes can profit by the lessons taught by each of these catastrophes. As a matter of fact, this is precisely what they are doing.

Conspicuous, as a cause of accident, is what one may call the structural weakness of a machine. Of the accidents I have dealt with, a surprisingly large number can be attributed to the breakage of some part of a machine while in flight. It should be stated, however, that in more than one case the collapse of some portion of his apparatus has been very largely due to a pilot's daring, in placing too great a strain upon it while performing a steep dive, or while

A wreck in landing. Mr. Clifford B. Harmon's Farman biplane wrecked at the Harvard-Boston Aviation Meet, Atlantic, Massachusetts

making some abrupt turning movement. As, however, it may be said that an aeroplane should be strong enough to bear any sudden strain imposed upon it, I have classified these accidents under the general heading.

It will be seen, therefore, how extraordinarily important it is for a greater strength in construction to be adopted. A hopeful point, in this connection, is that, recently, accidents directly due to a failure of any part of the machine have occurred less frequently.

Strength in construction has, as a matter of fact, become one of the builder's principal aims. With a great deal of experience now behind him, he sees, more clearly than he did at first, just where it is necessary to add strength to his craft. The aeroplanes which we are now provided with are far more workmanlike jobs than were those built in the beginning of the movement.

That greater strength in construction will be adopted in the future goes almost without saying. What this will mean in increasing the safety of flying can be gathered from the fact — as quoted before — that fourteen out of thirty-two fatal accidents have been due to the breakage of some portion of the machines.

Another fruitful cause of disaster, which will be lessened in the future, comes under the heading of "engine trouble." In the catastrophes which have been dealt with, I find that several

come under the classification of the stoppage of a man's engine while in flight.

This means, in most of the cases, that a pilot was suddenly robbed of his motive power, and was unable to make a satisfactory glide to the ground. As I have emphasized before, and may emphasize again, the stoppage of an engine in mid-air does not, as a rule, spell disaster when the pilot is skilled. I have myself been confronted with this difficulty on more than one occasion, and have been able to make a safe *vol plané*. But, if the pilot is flying in a high wind, and his engine fails him, then his danger is great. And there is a great element of danger, also, in the giving out of one's power when passing over country which does not provide a good landing-place.

Therefore, it is clear that one of the essentials for development in the future is to make aeroplane engines more reliable. How well work is progressing along this line may be seen when it is remembered that flights of four and five hours, without descending, are now matters of everyday occurrence.

Already, though we have not gone far in an investigation of the causes of aeroplane accidents, it is possible to see how greater safety is to be obtained. If the structure of aeroplanes can be made more substantial, and if the danger of the stoppage of an engine can be obviated, we can

Mr. Ralph Johnstone in a Wright biplane and Mr. Grahame-White in a Farman biplane on the home stretch at the Harvard-Boston Aviation Meet, Atlantic, Massachusetts, September, 1910

see how nineteen out of the thirty-two accidents chronicled in the previous chapters might have been averted.

That engine troubles will be entirely eliminated is too much to hope for. What engine makers have in their minds is to improve the aeroplane motor so that it runs as reliably as does the engine in a modern motor-car. If this can be done, a very great and important stride will have been effected. It is a fact that already one or two makers of aeroplane engines are approaching very nearly to this ideal.

A disquieting feature of the accidents to aeroplanes which have caused the pilot's death is that an appreciable percentage of them must be said to be mysteries. This does not mean that theories were not advanced to account for them. Many were, in fact.

But, after going very carefully through the evidence forthcoming, I have not thought it safe to make any definite decision as to what was the cause of the disaster. Of these six accidents, which are classed as being from "causes unknown," one may be permitted perhaps to make a further reference.

In regard to Chavez, killed after his great Alps flight, all one can say is that he *probably* came to grief owing to being numbed by the cold. Regarding the death of Herr Plochmann, killed at Hausheim, there is absolutely no material

forthcoming. Captain Madiot's death at Douai cannot satisfactorily be explained. Mr. Cecil Grace's death will always remain a mystery, I think. We know, of course, that he flew into a fog, but what exactly happened to him after that no one can say. The sixth mystery, which concerns Lieutenant Caumont, is equally perplexing. His rudder may, as some say, have failed him, or he may — as I was told by some one — have been trying too powerful an engine in his monoplane.

Many people imagine that a large number of accidents to aeroplanes are caused by the pilot endeavoring to fly in too high a wind. But my analysis of the fataliites we have been discussing does not prove such to be the case. As a matter of fact, very few of the disasters are attributable to a machine being turned over while flying, owing to the onslaught of a dangerous wind gust. To be precise, one can only put down the deaths of Robl, Poillet, Picolli, and Moisant as being due to flights conducted in winds which were too high.

This, it must be granted, says a great deal for the stability of aeroplanes, and is, in fact, a most hopeful sign for the future. A great many flights have, without doubt, been conducted in winds which were of considerable strength. And yet, despite the attacks of wind gusts, the pilots have been able to fly safely. If this can be done with

such machines as we have to-day, what will be possible with the stronger, faster flying craft which we shall possess before very long?

In the beginning, one may note, no flights were attempted save in dead calms. Gradually, with an increasing skill, pilots began to venture into the air when winds from five to ten miles an hour were blowing. After this, with an accession of speed, flights were attempted in even higher winds. The result is that, to-day, we have flying carried out in winds blowing at a velocity of from twenty to twenty-five miles an hour. What it is now the intention to produce, if possible, is an aeroplane capable of weathering a wind of from 35 to 40 miles an hour.

A very small proportion of aeroplane accidents are due to a pilot's mistake. This is, without doubt, a very hopeful sign. If machines can be flown, at the present day, with so much certainty on the part of the man at the controlling lever, it says a very great deal for the general safety of flight.

It disproves, for one thing, the contention advanced in the early days of flying that a man must, in order to fly, become a sort of aerial acrobat. I have heard this argument advanced on many occasions. It was held that only men of a certain agility would be able to learn to fly. And yet what is the case? On one estimate, as I have said, there are now, in the world, close

upon 3,000 men who have acquired the knack of piloting a power-driven machine.

The majority of these men have learnt to fly with astonishing rapidity. In some cases, only a few hours' actual practice has been sufficient for a man to acquire mastery over his machine.

Therefore, it must be taken for granted, from the evidence of facts, that there is no special difficulty about learning to fly.

In this connection, also, it must be remembered that, in the present type of aeroplane, the pilot is expected to do a good deal more in the way of personal control than will be demanded of the man who controls one of the perfected machines of the future.

In a final remark on this subject, one may take it for granted that the prospect is hopeful. Although these thirty-two fatalities to which I have referred are greatly to be regretted, their number is not excessive considering the large amount of flying that has been done.

As has been seen from my summary of the causes of these disasters, it is possible to show how many of them may be averted, in the future, by greater strength of construction, and by increased reliability on the part of aeroplane engines.

One of the greatest considerations, as regards the future of flying, is that of speed. From the very first, airmen have seen that there is only

one way by which the violence of winds may be combated — and that is by speed.

Unfortunately, however, there are a great many considerations which have to be weighed before a high-speed aeroplane is constructed. One of the chief of them is the strength of the machine. By those who first talked of speeds of one hundred and one hundred and fifty miles an hour the question of how the planes of a machine would stand the pressure upon them was scarcely taken into consideration.

Many of the accidents which have marred the progress of flying have, without doubt, been due to a pilot subjecting his machine, when in the air, to a strain which it was not strong enough to stand. It is clear, in fact, that, before very high speeds are attained, the construction of aeroplanes will have to be greatly altered. At present wood, wire, and canvas are the constructional features of the aeroplane.

At speeds of forty, fifty, and sixty miles an hour the planes can be built sufficiently strong to stand the strain, but when eighty and one hundred miles an hour enter into the question it seems improbable that we shall get a plane made in this way that will stand the pressure put upon it. This pressure, of course, increases enormously when a speed, say of sixty miles an hour, is passed.

Metal, naturally, occurs to one as being the

next material to be employed, and, without doubt, metal construction will enter into the aeroplane of the future; but, at the present time, metal for constructive purposes offers many disadvantages. Primarily, its weight renders its use almost prohibitive. With a certain engine power, with a certain weight, and with a certain surface, manufacturers know what they can do; but the all-metal aeroplane opens up quite new possibilities. When engine power is very greatly increased, as it may be before long, there is little doubt but that greater speeds will be attained, and far more heavy forms of construction adopted.

The present-type aeroplanes, with their wings of wood and fabric supported by wire, have a great deal of elasticity when they land on the ground after a flight. The wings "give" to the shock, and the whole machine takes the strain equally, but with the few attempts that have already been made to employ metal for wing surfaces it has been found that the lack of elasticity in this method of construction is a bad feature. Instead of giving to the shock of landing, the metal wings have been "kinked" and in some cases broken.

The problems which are looming up to be dealt with in the future are, indeed, very difficult. Speed must be attained if the conquest of the air is to be fully achieved. Engines have be-

come so reliable, in a sense, that the next development of flying must be to increase the power of a pilot to steer his craft in high winds.

To the general public, particularly, this inability of the aeroplane to be anything save a fine weather craft is a great point against it. The progress that has been made during the last year in the matter of increasing the reliability of engines and in perfecting many details of the aeroplanes has been to a great extent lost sight of. What has struck the ordinary observer is the fact that when a high wind is blowing the airmen are chained to their sheds.

In such a contest, for example, as that of the De Forest cross-channel flight, for which attempts were being made last December from Dover on the English coast, the outstanding fact in the public mind was that weeks went by before one of the competitors could dare to cross the sea. And, certainly, flying will not be universally adopted by Governments unless the machines have a greater ability to make flights when the wind is blowing strongly.

A great deal of progress has of course been made in this direction. One has only to turn back one's thoughts to the early days of the heavier-than-air machine. When the Wright brothers were first flying, and when Henry Farman had achieved his first flights with his Voisin biplane, it was considered madness to attempt to fly unless there was a dead calm prevailing.

It was Hubert Latham, with his Antoinette monoplane, who first showed that wind-flying was a possibility. Aided by the size of his machine, the dihedral angle of its wings, and its weight — and also, of course, by his own skill — Latham made several ascents in winds which were then reckoned to be dangerously high.

As man's confidence in flying grew, he dared higher winds, not because the machine he possessed was any better fitted to conquer them, but because he found that it was possible by skillful movements to fight against sudden gusts. Thus, by degrees, we found pilots flying in winds of fifteen miles an hour, and making quite good weather of them too.

Then, to help airmen in their fight against the wind, came the introduction of the monoplane with the Gnome motor. With this combination of a light, fast machine and powerful motor, speeds of fifty and fifty-five miles an hour were easily attained. With such machines, having a greater speed than the biplane, it was found possible to fly quite safely in a wind of twenty miles an hour. Particularly daring pilots even ventured aloft in twenty-five and thirty mile an hour winds.

Practically speaking, our present stage of development amounts to this. With a monoplane one may fly in a wind of twenty or twenty-five miles an hour. With a biplane one's limit is per-

haps twenty miles an hour. This is merely suggested as a general rule. Under exceptional circumstances and with exceptional men, higher winds may be braved.

Even in connection with winds of this strength, there may be a moment of danger when the pilot seeks to return to the ground. As he approaches the landing-spot and nears the ground, he may be caught by a dangerous eddy and compelled to effect a bad descent. A good many times, in fact, a pilot has started away to fly in a high wind, and has been able to keep in the air quite well during his flight, but has been wrecked on landing at the end of it.

In fact, to make an aeroplane a thoroughly reliable wind-flying machine, a great many improvements are necessary. So far as the existing machines are concerned, we have certainly reached the limit. Our engines are sufficiently reliable for a 6, 7, or 8 hours' flight. The planes themselves have been made, by the experience of their manufacturers, very much more efficient than they used to be. The controlling mechanism of the machines has been so carefully thought out that it represents not exactly perfection, but a very great improvement.

As regards the landing devices, in which combinations of wheels and skids are usually employed, here again the greatest progress is evident. Flights across country are of almost daily oc-

currence. High flying has been improved to an amazing extent. The number of airmen grows with great rapidity.

In all things, in fact, save wind-flying, airmanship has made extraordinary progress. But when all is said and done we come back again to this question of combating the wind. No practical person will regard flight as an accomplished or definite thing unless one can say that one will start on a certain day, at a certain hour, to go to a certain place, and be able to keep one's word.

No passenger-carrying service will be possible, either, until the aeroplane is able to meet adverse weather. Of course one does not imagine that a flying-machine will be able to fight against a gale. Nobody expects that — at least not for a very long time to come. But what the aeroplane wants to do is to be able to fly in any such high or gusty wind as we have on many days in the year. Such winds do not approach the velocity of gales, but they are sufficient, at present, to keep an aeroplane to the ground. It is clear that the aim of every one who has the interests of flying at heart must be to rid the aeroplane of this reproach of being unable to fight a wind.

M. Bleriòt, M. Farman, M. Paulhan, and nearly all the greatest of the world's thinkers in the matter of air craft are now hard at work upon this problem of conquering the wind. M. Paulhan has very clear and definite ideas on the

subject. His theory is that a machine must be made with its plane surfaces capable of being altered in size as the machine passes through the air. Already with an experimental machine he has demonstrated that the mechanical difficulties of reducing the surface of a plane without robbing it of its strength can be overcome. The idea of this reduction in surface is simple. If it can be brought to perfection, some design will be adopted whereby a pilot, by the movement of a lever near his seat, will be able to "reef" his sails like those of a ship.

When one is moving along the ground preparatory to a flight it will be necessary, under this system, to have the maximum of surface exposed to the air. Probably in a biplane it may be arranged that the rear edges of the main planes will furl up as the pilot wishes to reduce his surface. As regards the monoplane more than one inventor has thought of a method of making the extremities of the wings telescopic, so that they can be lengthened or reduced at will. Though this system awaits definite trial it has many possibilities to commend it.

The difficulty with any system of making a monoplane's wings with a variable surface is that the wires which hold the wing rigid interfere with any alteration of its shape or size. But, of course, in discussing any developments in this way one need not assume that the biplane or mon-

oplane will be the machine of the future. So far, development has worked along certain lines. But the machines we have to-day may not be the machines of to-morrow. Personally I think we have reached almost a limit as regards present types of construction. Something new is decidedly wanted.

No doubt, seeing that the demand has been created, it will come. If a machine with variable surfaces can be devised, and even if such a machine differs little in construction from our present ones, a distinct step forward will have been made. The idea governing the system of varying the plane surfaces is a very sound one. When the first demand came for a high speed machine, the hasty opinion was formed that it was only necessary to increase the engine power and so get the desired result. But although an increase of speed was made by such a straightforward plan, difficulties soon arose. For instance, let us take the monoplane to which an engine of 100 horse-power was fitted — just doubling the power that had driven it before. With this machine it was possible to fly, under favorable conditions, at a speed in excess of 70 miles an hour.

This sounded, on the face of it, a very distinct step forward. But although the machine flew very well, it had to land at such a high speed that its use was practically confined to aerodromes, where a perfectly smooth surface could be relied

upon for returning after a flight. Thus, although when in the air this machine fulfilled the need for greater speed, its practicability was marred by the fact that it could not be used, reasonably, as a regular cross-country machine. Had one done so, and had a landing been attempted on anything like rough ground, the under carriage of the machine would not have stood the shock imposed upon it.

Thus it was seen that there was more in the question of increasing speed than had been at first imagined. This fact was quickly realized — the successful high speed machine must leave the earth at a moderate pace and only attain its maximum when well away from the ground, being provided also with a capacity to effect its landing on a rough surface if necessary by greatly reducing the rate of its descent.

The ideal, I suppose, would be a machine which would soar into the air with a large plane surface at a speed of some 20 or 25 miles an hour, and then quicken its rate to a maximum of anything from 100 to 150 miles an hour, while retaining its capacity, by increasing its surface, of descending safely at about the speed it had started away with.

At the present time, of course, there is a feeling that one cannot very well complicate machines to any extent. To ascend with some complicated mechanism, and have it fail you when

you wish to put it into operation would be a highly dangerous and perhaps fatal thing. Thus progress with any variable surface device will, I think, only be made by slow and careful stages.

Testing new ideas with the aeroplane represents a good deal more difficulty than putting new ideas into application in any other form of machine. But, still, this variable surface type of aeroplane is one we are all striving for very diligently. If we can get it, a new phase of airmanship will be opened up. Exactly what improvement this new type of machine will represent it is difficult to say. From the point of view of combating winds it will be invaluable. Although it may be wild at the moment to talk of speeds as high as 150 miles an hour, I think that, eventually, we shall see such an ideal realized.

If one could get a machine flying at such a pace with a minimum of surface it is clear that it would be practically immune from attack by the wind. With a machine which one could take out and fly upon when high winds were blowing the commercial aspect of aviation would be a very much more hopeful thing.

Personally I have every confidence in the future of flying provided we can go ahead in the way I have indicated. From the military point of view a very high speed machine capable of being used in rough weather as well as in calms would be extremely important as a dispatch

carrier. From the point of view of reconnoitering it is doubtful whether high speeds would be of use, seeing that unless the machine was flying very high it would be difficult to carry out observations at a speed, say, of 100 miles an hour. But here again the variable surface would come into play. When approaching the enemy, or hastening back with news, an aeroplane could develop its maximum speed and still have the ability, by exposing more surface to the air, of halting, so to speak, when any observing work was necessary.

Apart, also, from its military aspect, I think a really practical aeroplane with a variety of speeds would make a far more definite appeal to the amateur than do any of the machines we at present possess. The speed at which he has to do everything is a distinct drawback in its way to the man who wants to learn to fly.

To the beginner, the pace at which he tears across the ground preparatory to flight, and the way the ground whirls away below him when he does get into the air, are both baffling and puzzling. In landing, too, the novice feels that he has only to make the tiniest error to bring about a disaster.

A friend of mine represented to me the other day that learning to fly on any machine such as one finds in the schools to-day was like trying to learn to drive a motor car which had only one

speed — the top one. The novice who learns to drive a motor car does most of his preliminary work at the slowest speed he can. Therefore he is able to accustom himself to the various mechanical features of the machine without moving along at any speed likely to confuse him or make him forget something that he has to do.

If a man who wants to learn to fly could take out an aeroplane and move about slowly with it until he has gained some mastery over its details, he would feel far more confident than is at present the case.

Of course the variable speed machine will have to be very perfect in its mechanical adjustment before it can come into general use. There must be no element of chance in it, and no fear that any one of the automatic movements is likely to go wrong.

Personally I rather favor the device of telescoping the ends of the planes of a machine to reduce or increase the surface. Upon this idea I am at present working, and it seems to me to offer a very profitable field for research. With a variable surface machine in actual operation one could extend the use of the aeroplane in very many ways.

Apart from the demand that there will be among governments for any perfected form of aeroplane, the first really practical and what one might call safe craft will surely be bought by such

Mr. Grahame-White's Bleriot monoplane just after landing at Belmont Park, Long Island, New York, October, 1910. Mr. Grahame-White was flying at a speed of about 85 miles an hour, and had to land at the same speed. The wheels struck a slight elevation in the ground with the result as pictured. The aviator was uninjured

wealthy people of leisure as are the great support of the motor car industry.

Whether such people will buy an aeroplane is often questioned, but it is generally argued in this connection that flying will never present as much safety as does touring in a well-appointed motor car. At the present time, I admit, this does not seem very possible. People are talking of the number of men who have been killed while flying. It seems as though the science had received some sort of a temporary setback.

When a man thinks how safe it is to motor along a good road with a good car, and then contrasts this safety with a flight in a present type aeroplane, it seems almost too much to hope that flying can be made as safe as motoring. It is interesting while upon this subject to ask really what are the risks of flying with such craft as are at present to hand. In the first place, until the wind flyer is produced the great element of danger in flying is an ascent under unfavorable conditions. But if a man is not compelled to fly at any given time and can take out his machine when the conditions are favorable, he can remove altogether this risk of the weather.

On a calm day, for instance, or in a breeze of from 8 to 10 miles an hour, flying is, so far as climatic conditions are concerned, perfectly safe. When I say perfectly safe, I am omitting reference to curious "air holes" and unexpected wind

eddies, which one is, in theory, expected to encounter.

But when flying over fairly ordinary country on a calm day I do not think this risk of falling into an air hole or partial vacuum is anything for a pilot to worry himself about. Even on fairly calm days one does of course sometimes come upon an unexpected eddy of wind when one is flying rather low or in the vicinity of rising ground. But here again, by flying at a good altitude — say 1000 feet — one can eliminate risk on this score. Therefore, if one is able to strike out the risk from the weather, what have we left?

I can imagine a critic of flying supplying the gap by alluding to structural weaknesses of machines which may cause some important part of one's machine to break while in flight. In the early days of flight such breakages were fairly common, it is true. But such accidents were only natural. Manufacturers were groping in the dark as to the stresses and strains their craft would stand.

It was only by experience that they discovered that some part of a machine should be stronger than another. It may be pointed out to me that even recently accidents have occurred through breakage of some part of a machine when in the air. But on this head I must point out that in recent times far more "liberties," if one can use the term, have been taken by pilots in their flights.

In the same way that a man can damage a motor car by racing it and putting it to undue stresses, so a pilot can weaken an aeroplane by performing unwise evolutions with it. To descend swiftly and then rise again steeply with a sudden alteration of direction is a severe strain on a machine. How severe it may be can only be gauged by the conditions prevailing at the time.

In such ways as this it is possible to come to grief even with such a strongly built and well-thought-out aeroplane as we can procure to-day. And then of course the element of danger in flying from the point of view of the breaking of any part of one's machine is greatly minimized if one has the common sense to examine one's machine carefully before starting for a flight. I myself have made it an unbroken rule to go over each part of my machine very carefully and very frequently. Of course one does not, before each flight, examine every wire and stay; this can be done periodically.

But what a man should do before he gets into the air is to see for himself that the wires operating his planes are in thoroughly sound condition. More than one life has been lost, without doubt, owing to this simple precaution being neglected. If one's machine is in good working order, one's controlling mechanism is perfect, and the weather is suitable, one is beginning to reduce the danger of flying very materially. What danger, in fact, have we left?

It is the danger of one's engine failing one while in the air. For this to prove disastrous is not necessary. Many times during my flying experience my engine has stopped, for some reason or other. But I have managed invariably to plane down, and make a safe landing upon some suitable spot that I have seen while in the air.

Of course the ability to make a good landing after one's engine has stopped involves a good deal of skill and some experience also. It is not until a pilot has made several *vols planés* without his engine to assist him that he has any feeling of confidence in venturing across country.

This question of making a swift and certain descent when one's engine has failed is a very important one; yet I have known some pilots who have neglected it. What happens when an engine stops in mid-air is that the machine, robbed of the power that is forcing it forward through the air, begins rapidly to lose its speed. If the pilot sat perfectly still after his engine had stopped, and made no motion of any kind, he would very soon come to a standstill in the air.

This would be fatal. It is only by its forward motion that an aeroplane is controllable. Therefore, when it has ceased to move forward, the pilot can do nothing more in the way of controlling it.

When a biplane stands still in the air, its ten-

dency is to descend tail first. Thus the pilot is in a hopeless position. Once having lost control of his machine he cannot regain it, and if he is flying at any height a fatal accident is almost inevitable.

With a monoplane, when the engine stops, the pilot who does not hasten to perform a *vol plané* has more chance of safety, because the engine of the machine is placed so far forward that its tendency is to draw the nose of the machine down and thus start it upon a natural glide. But, in practice, to lose control of a monoplane in the way I have indicated is almost as dangerous as to find oneself in a similar position with a biplane.

What, then, does the pilot do when he finds his machine coming to a standstill through the engine having failed him? He alters the angle of his elevating plane as quickly as possible, and turns the machine downwards at a fairly steep angle. This maneuver has the effect of giving the machine the speed that the engine has been supplying. It makes a sweep towards the earth and, by this accession of speed, is perfectly under the control of the man who is steering it.

So long as he can keep moving forward at a good speed the airman is quite safe, although his motive power has deserted him. What he does is to plane down at a good speed, continually on the look-out for anything that looks like a good landing spot.

A good-sized grass field is of course the ideal. When he approaches it he slows up his machine and lands with as little shock as possible. Of course a good deal of skill is necessary before a *vol plané* can be done with safety. It is difficult to make any considerable turning movement while coming down on such a glide. The danger of so doing is, of course, that one should rob the machine of its impetus.

Therefore, supposing an engine stops when one is flying 1000 feet high, one has to pick a landing spot fairly quickly, and concentrate one's whole attention upon reaching it in a safe glide. Here the element of risk is represented by the nature of the country one is flying over. If one deliberately sets out upon a cross-country flight, knowing that between one's point of starting and stopping there is no really suitable landing spot, then one is embarking upon a very risky experiment.

Of course in this argument I am assuming that flying is not being done for any set purpose, but merely as a pleasure cruise, just in the same way that one might take a car out and enjoy a spin. On such a motor trip one would not choose the most dangerous or difficult roads; and for the same reason in flying, when a man is flying only for pleasure, he would naturally seek a cross-country flight which did not present any very great risks should his engine fail him.

Therefore we shall assume, in this argument, that the pilot is not passing over risky country, but over land which presents him with many opportunities for making a landing. In such a case, should the engine stop, it will be quite possible to make an easy landing, even if the airman is not exceptionally skilled. All he has to do is to tip his craft down and glide to the point he thinks best.

One may, in fact, argue that flying is safe when carried out under favorable conditions. In the use of the words " favorable conditions " I mean conditions that are favorable in every way. A good machine, a good day, and good country, and with a pilot who thoroughly understands what he is doing.

The martyrs who have sacrificed their lives in the cause of flying have done so very largely because they have been so enthusiastic as regards the progress of flight. Some of them have been impatient of the slow progress that they have thought was being made. They have wanted to try new methods, to experiment with some suggestion that has occurred to them. It is undoubtedly true that the man who does seek to carry out new ideas regarding flying is running a very grave risk. This does not apply, of course, as regards the man who experiments with variations of some usual type. For instance, the man who made a single-seated monoplane and then

designed one to carry two passengers was not running any very great risk when he tried the passenger-carrying machine. His previous experience with the single-seated model had shown him a great deal that he wanted to know.

But the man who takes a machine which is of some quite revolutionary character and seeks to fly in it, is risking a great deal. In mentioning this point, the safety of flying is suggested to me by the experience of one pilot I know very well. He bought an aeroplane in the very early days of flying. This machine he still owns. With the exception of a few minor adjustments and a few simple repairs, the machine to-day is almost as good a flyer as ever it was.

The engine has run with extraordinary reliability. During all his flying experience, and this pilot has flown very industriously, he has never had any accident of a serious kind. He has had all the enjoyment of flying with very few of its risks. His precautions have been very simple. All he has done is to refrain from risking anything. If the weather has not been favorable, he has not taken his machine out. He made a plan when he first took up flying that he would not make anything in the nature of a risky flight, and that policy he has adhered to throughout.

If the wind has been more than, say, 10 miles an hour, he has not flown. He has always selected good flying grounds. He has been very

careful to employ only good, careful mechanics. He has himself examined his machine closely before making a flight. The result has been, as I have said, a complete immunity from accident. This pilot is quite an ordinary type of man. He was before flying, and is now, a motorist. His interest in flying was the healthy interest of a man who was attracted towards what he thought was a new and exhilarating sport.

The consideration of one or two cases like this makes the prospect of flying far more hopeful. Of course the human element enters very largely into such a thing as flying, and it is this human factor which has increased so greatly the recent death roll. In most things in life, after a time, a man becomes a little careless. One always hears this said. As regards railway men, as regards men who are in other and even more dangerous occupations, one is told that familiarity eventually brings some form of contempt.

Now with flying it is scarcely carelessness so much as the endeavor to do something new that has brought this trail of accident. It is not human, I suppose, to be prepared to make such slow progress in flying as would have ensured that progress being safe. It is a fact that, had men been willing to go ahead as slowly and as pleasurably as has done the man to whom I have just referred, the present state could have been arrived at with scarcely any loss of life at all.

It is a notable fact, and one that is much commented on, that some of the men who have been killed, particularly those abroad, have been exceedingly expert flyers, and men, in some cases, who have been instructing pupils in their work. This, however, is not surprising to me. Given a man of a certain temperament, the fact that he has become thoroughly accustomed to his machine and to being in the air introduces an element of danger. I myself have noticed — and, after all, it is quite human — that a man who may have become famous for a particularly daring *vol plané* will make his descent steeper and steeper as he goes on. The result is that one day he meets an unexpected gust of wind, or something on his machine may give way through an excessive strain.

What happens is that this fatality is reported as being another indication of the danger of flying. Of course such a conclusion is very unfair to the aeroplane and to the sport. It is not through the danger of the machine, but through the man having attempted too much, that the accident is due.

Keen experimenters in such a new and rapidly increasing science as flying are always in danger of forgetting their own safety in their ardor to make progress. More than one case comes to my mind of a man who has met with disaster while actually putting to the test some theory that he has evolved while flying.

In this connection, too, one cannot help commenting upon the question of exhibition flying. Here, no doubt, one has a source of danger. Later on, when aeroplanes are far more perfect, it will be possible to give exhibition flights with very little risk. But the danger has arisen from the aeroplane being exploited so vigorously before it was really a sufficiently safe instrument for such a thing to be done.

Of course there is another aspect to exhibition flying, and one which has very largely appealed to me. It is this — that unless people see an aeroplane in flight, and unless you can awaken interest in flying, very little useful work will be done. For this reason on many occasions I have put myself to personal inconvenience to perform some exhibition flight.

In the statement that it is easy to fly some qualifications are necessary. Flying is easy, but only up to a certain point. On a fine day, flying round and round an aerodrome, one cannot imagine anything very much more important than the control of an aeroplane.

But this is flying in its most favorable aspects. When conditions are good, and a machine is running well, there is nothing so delightful as aeroplaning. But it is an unfortunate thing that the dangers of flying should be hidden. They lurk in wait for an unwary beginner. He may take out his machine a number of times and perform clever evolutions with it.

In turning he may "bank" over to a surprising angle, and yet feel quite confident that he has his machine well in hand. And then something happens. What it is he does not quite know. He makes the second turn, perhaps, in precisely the same way, and all seems to be going well. Suddenly, however, probably because an unexpected gust of wind gets under his planes, he finds, to his consternation, that the machine will not come straight again as it has done before.

The result, if he is lucky, is nothing more than a wrecked aeroplane, and a severe shaking. From such an experience an airman emerges a much wiser man. After this he does not take chances. He becomes a respecter of these unknown dangers instead of defying them.

Unfortunately, some pilots learn their lessons by meeting with an accident which robs them of life. Piloting an aeroplane, in the air, is like exploring an unknown sea. You do not know from where the next gust is coming. Experience, of course, is of very great value in combating high winds.

For an aviator to obtain the certificate of proficiency from the Aero Club in whatever country he happens to be three flights are, at present, required. During the course of them, the airman circles round a prepared course, and is called upon to land within a hundred and fifty feet of a specified point.

But it has already been suggested, and the new rule will come into force quite soon, that more stringent requirements should be complied with before a pilot obtains a certificate. The danger of allowing an airman to gain any certificate too easily is that, after gaining it, he is able to give demonstration flights before large numbers of people. An inexperienced pilot, ascending perhaps in too high a wind to meet the demands of the organizers of any flying event, might very easily cause a dreadful disaster by descending upon the people.

It is because it is so easy to acquire a superficial knowledge of flying that a pretty serious test should be imposed before a man is able to describe himself as being thoroughly competent. While upon this point, it may perhaps be permissible for me to touch again upon some of the accidents which have occurred in connection with flying. I am afraid that in many of them inexperience has played a very prominent part.

In more than one case, which has come under my personal knowledge, a pilot has ascended to a considerable height, almost at his first flight, and without any knowledge of the art of making a *vol plané*, or aerial dive, should his engine stop while in the air. Of course, such foolhardiness only infrequently brings anything in the nature of a bitter retribution. When it does, however, the cry is that another man has been done to death owing to the perils of flying.

Such a view is, of course, quite wrong. It is essential, if a man wants to learn to fly safely, that he should not venture to great heights unless he is sufficiently skillful to be ready, at any moment, to make a *vol plané* should his power give out.

The making of a *vol plané* may thus be described. When an aeroplane is flying, its engine, through the medium of the propeller, is forcing it ahead, and giving the pilot control of it through the very speed with which it is passing through the air.

Now suppose that the engine begins to fail. What happens? The aeroplane commences at once to lose its speed. If a pilot steered straight on, after his engine had ceased to revolve, the result would be that the aeroplane would soon come to a dead-halt in the air. Then, being utterly powerless to control it, the airman would find himself falling backward or perhaps sidewise towards the earth.

What has to be done, when an engine stops, is for the pilot to tilt his machine downward and forward as rapidly as he can. The result of this maneuver is that the aeroplane, in falling toward the ground, is given, by the momentum of its descent, sufficient steerage way to counteract the loss of power.

It comes gliding down pretty fast, and at a fairly steep angle, until the pilot sees that he is

within 40 or 50 feet of the ground. Then he "straightens the machine out," as it is called, or rather checks its downward descent by a movement of the elevating planes, and so manages to make a safe landing.

The beginner who flies at a good height, without having first acquainted himself with the knack of making a *vol plané,* is running an extremely grave risk. The movement by which a machine is tilted downwards, after the engine has stopped, has to be made very definitely and without a moment's hesitation. If a person unaccustomed to such an emergency is suddenly confronted with the stopping of an engine it is highly probable that he may become confused, and fail to point the nose of the machine towards the ground with sufficient rapidity.

This question of the *vol plané* is very important when one comes to consider cross-country flying. When making a cross-country flight, one may be faced at any time with the difficulties attending an unexpected failing of the engine.

If one is lucky a nice open tract of country may lie below. From an altitude of 1,000 or 1,500 feet, which is the safe height at which to fly across country, one must come planing down, keenly on the look out for any smooth field in which the machine may be brought to rest.

This requires a great deal of judgment. In selecting a landing point one cannot change one's

mind at the last minute. The machine, in gliding down without engine-power, cannot be checked to any very great extent. Were this done it would become unmanageable and fall.

Therefore, if the pilot chooses a field to come down in from a height of a hundred feet or so, that field he has to come down in. Of course it might be possible to turn a little to the right or left if the ground was seen to be exceedingly bad, from close inspection, but such a maneuver would be attended with a good deal of risk.

The difficulty of making a landing, after an engine stoppage, is very much greater when the breakdown comes at a moment when the pilot is passing over woods or hills or perhaps even over a town.

Then what is required is a nerve of iron. There may, perhaps, be only one small spot in sight upon which a landing is possible. The pilot has to maneuver his machine with extraordinary care so as to be able to reach this place without losing whatever speed he has got upon his machine. It is only by the exercise of the greatest care and skill that a *vol plané* can be safely and surely made.

For a beginner to attempt cross-country flying, without having previously made several intentional *vols planés*, is an extremely dangerous proceeding; and yet, as I have said, I have known of many cases in which an enthusiastic airman has

Mr. Grahame-White, with Mr. Clifford B. Harmon, adjusting the latter's Farman biplane in the *hangar*, at the Harvard-Boston Aviation Meet, Atlantic, Massachusetts, September, 1910. After Mr. Harmon had smashed his biplane on the first day of the meet, Mr. Grahame-White loaned him his own Farman biplane, and Mr. Harmon won all the Amateur prizes

been tempted to rise to a great height and to fly from point to point relying solely upon the power of his engines, and being in dire distress should this power fail him, and a compulsory descent be necessary.

CHAPTER XIII

THE VALUE OF PRESENCE OF MIND IN FLYING

When in January, 1910, the news came of the death at San Sebastian of M. Leblon, one of the most expert pilots of the Bleriot monoplane, many people remembered the very remarkable feat which he achieved at the first Doncaster meeting.

I make a special reference to this act of Leblon's, because it illustrates a feature of aerial work. To be a successful airman, one needs in the present stage of these machines to possess good judgment, and also — to a remarkable degree — to have very ready presence of mind.

Unexpected things are always happening in the air. The man who is not ready to cope with any emergency that comes along may find himself in a very awkward predicament.

Of all the cases in which a splendid presence of mind has been displayed in the face of a highly critical situation, I do not suppose that a more impressive instance could be found than that of Leblon's effort to save the crowd at this Doncaster meeting of 1909.

The story, as it has been told to me by some of my friends who saw it, is indeed a remarkable one. It showed Leblon to have been the possessor of infinite resource — and heroism as well. Leblon, before he took up flying, was a well-known racing motorist. He had a characteristically thin, hawk-like face, which was alive with energy and enthusiasm. His quick, keen eyes told of a mind trained to decision, and swiftness of action.

A remarkable thing about Leblon was his long beard, for which he became notable in motor racing. It blew out after him in the wind as he tore along in racing cars. He was unvaryingly quiet of speech, and had a manner which was strikingly in contrast to the quickness of his actions, and the muscularity of his frame.

As an airman, Leblon sprang very suddenly into prominence. Learning to pilot a Bleriot monoplane, he became a thoroughly proficient pilot in an astonishingly short space of time. His characteristic, as a flyer, was to "climb" very rapidly into the air from the moment he left the ground. People got into the habit of saying, "There goes Leblon," when he literally jumped into the air after a short run along the ground, and soared up quickly to a height of several hundred feet.

The scene of his greatest feat — certainly one of the finest examples of presence of mind ever

given — was the Doncaster Aerodrome. It was a dull, windy day. Around the two-mile course a large crowd had gathered. They had come to see the flying, but had been compelled to wait, bcause nobody quite cared to go out in the tricky wind that was blowing.

Just before it had been decided to abandon flying for the day, Leblon brought out his monoplane with the remark, "I will try a flight, just so that the public shall not be disappointed." The remark was typical of him. From a good many people there was disapproval. Some of the more cautious among his fellow. airmen strongly dissuaded him. But Leblon would listen to no arguments. He got out his machine, and replied to cautions with a shake of the head, and a confident smile. He rose into the air and sped away. The tree-tops fringing the aerodrome were swaying in the treacherous, gusty wind.

When the crowd saw that Leblon had come out to fly, so that they should not be disappointed, there was naturally a roar of applause. Everybody watched the pilot with keen excitement as he made a flight a hundred feet above the track. More than once the monoplane slid suddenly sideways through the air, the plaything for the moment of a vicious gust. At this, the cheering crowd fell silent, and many people held their breath. But Leblon brought his monoplane back again into balance quite safely, and made more than once a reassuring wave with his arm.

After the pilot had been flying for only a short distance, and was approaching a part of the course where, upon his right hand, the crowd was thickest, a quite unexpected thing happened. A gust of wind caught the aeroplane partly from above. It pitched wildly, then it swerved sideways and approached the ground. It was evident to those who were looking on that the airman could not check the descent of his machine. It landed at a high speed, striking the ground a slanting blow. In its fall, it had turned sideways, and was now facing towards the people. As a matter of fact, although he had appeared helpless, Leblon had managed very dexterously to keep his machine under sufficient control to be able to make a safe landing. His speed, however, was very high. Directly in front of his machine, as it ran along the ground, was a line of rails, and a deep ditch. From the point at which he hit the ground these rails were not more than fifteen yards away. Behind them, some thirty yards further off, leaning against a second line of rails, were the close-packed ranks of the people.

Nobody who was watching the airman's immediate peril of coming to grief in the ditch realized the far greater danger which was lurking in the background. As he sped over the ground, at a speed that could not be checked, Leblon was a sufficiently good judge of pace to

be able to see that he could not check his aeroplane before it went crashing into the railings, and afterwards into the ditch. He knew also that the result of the impact, as the machine charged the railings at a speed of some thirty miles an hour, would be disastrous to him. He knew quite well that at such a speed the machine would be broken up, and that he would in all probability be killed.

In a second Leblon made up his mind what to do. This was his first indication of absolute self-possession. He allowed his machine to charge directly at the railings for a second, facing the breathless crowd. Then, having judged his distance, with remarkable skill, he suddenly brought back his lever with a movement that caused the aeroplane to jump from the ground. With one bound the monoplane was in the air and had cleared the ditch and railings like a steeplechase horse. To those who were watching him, it seemed that the whole thing had happened in the twinkling of an eye. After this remarkable movement Leblon had intended, as he explained afterwards, to bring his aeroplane to a halt in the space between the railings and ditch which he had passed over, and the second line of railings against which the people were standing.

This maneuver he had decided upon because he had observed that immediately behind the spectators there was a fringe of tall trees. Had

he kept on his way, after flying over the first railings, and over the heads of the people, he had calculated that he would not be able to rise sufficiently high to clear these trees. So he decided to come to rest on the open space between the two sets of rails.

But the wind was blowing behind him, and his machine was traveling much faster than he imagined. Although he dropped his machine very quickly after clearing the first rails, thus hoping to check its speed, he found to his dismay that he was merely running out of one peril into another.

He saw at a glance, as his machine was running along the ground, that its momentum would carry it with a crash into the rails against which the people were standing. He saw too that the people were too tightly wedged together to be able to draw back and avoid him.

In one second, in this new predicament, Leblon had to make a very important decision. What was he to do? He realized that were he to run on there would be a dreadful disaster. At the same time he saw that should he be able to rise in the air again, and fly over the people's heads, he would almost certainly come to grief in the trees which stood behind the people. Those who watched the airman's predicament from the course exclaimed that it was a veritable death trap.

But Leblon acted again, when he did so, with lightning speed. He realized that whatever he did he must not charge the close-packed crowd. And yet, lurking behind them, were the dangerous trees with, as an additional complication, a high palisade.

Seeing the aeroplane come tearing towards them, the people who were in the front rank of the crowd did their very best to draw back. But in this endeavor they were prevented by the weight of the people behind them, who did not see the danger which was impending, and who therefore stood stock still.

All round the aerodrome, in the few seconds that passed after Leblon had struck the ground, the people stood breathless, waiting for what they feared would be the fearful crash of the machine striking the railings and collapsing into the midst of the crowd.

But Leblon, quite unflurried, although one perilous situation had been followed immediately by another, even more fearful-looking, made up his mind exactly what he was going to do. He decided that, come what mav, nobody but himself must be endangered.

As he said afterwards, in quite a simple, unaffected way, " I had to save the people." And this, in fact, he did with an altogether extraordinary exhibition of skill and presence of mind.

Just at the moment when it seemed that he must come hurling among the people, Leblon acted. Waiting until the crucial moment came, he elevated his machine. To those who watched from the center of the course it appeared as though the monoplane jumped into the air like a thing of life. There was a flutter of white planes and that seemed all. The monoplane appeared to stand upright in the air. Then it shot over the heads of the people and disappeared from view.

What had happened nobody really knew until a moment or so afterwards. Officials came rushing across the course towards the place where the aeroplane had disappeared. Vaulting over the railing and thrusting their way through the crowd, they saw Leblon's aeroplane lying a complete wreck. It had come down beyond the last row of people, and only a few yards away from the trees and the wooden palisade which the airmen had seen and feared. Leblon himself, before the officials had come up, wriggled from under his wrecked machine without a scratch upon him.

Delagrange, whose monoplane Leblon was flying at the time, was one of the first who came up to him. With no thought of his ruined aeroplane, Delagrange began to congratulate his colleague upon extracting himself so remarkably well from the dreadful predicament in which he had found himself.

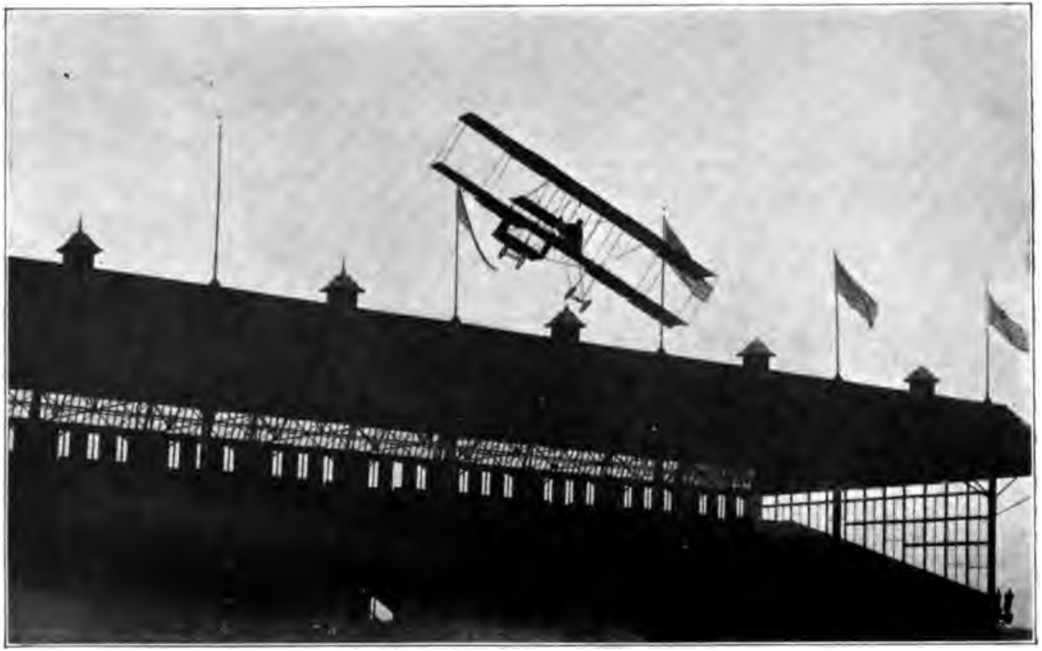
But Leblon did not seem at all concerned regarding his escape. He apparently thought that he had done one of the most ordinary things imaginable. His great concern was as regards Delagrange's broken monoplane.

"I am so sorry," he said. "I did my very best to save the machine, but it could not be done. The people were right in the way, you see, and I was helpless. All I could do was to miss them, and then come down here as quickly as I could. Otherwise I should have struck the trees, or the wooden fence, and come to grief very badly."

This was all that Leblon said. Other people had to discover for themselves what a remarkable thing it was that he had done. It appeared that he had jerked his monoplane into the air when it was almost in contact with the rails against which the people crouched.

Shooting over their heads, so low that more than one man's cap was blown off by the rush of wind from the aeroplane, Leblon had touched no one.

Between the spot where the lines of people ended and the fence which came before the trees began, Leblon had decided that he must make his descent. Fortunately, on this one open space that presented itself, there were no people moving about. So, manipulating his machine in precisely the right way, Leblon came swooping



Mr. Grahame-White flying over the grand stand at Bennings, near Washington, D. C., October, 1910; note the angle made in turning

down so as to land in this small spot. The remarkable feature was that there were people on both sides of this little gap, but none actually in it.

Leblon could not adopt any method as regards his descent. He just came falling down, and landed so heavily that the wheels of his machine collapsed, and he felt the whole of the under part of the machine breaking to pieces under him.

But in a situation which would have confused nine hundred and ninety-nine men in a thousand, Leblon had emerged quietly triumphant. It was one of the greatest losses to airmanship when this extraordinarily well-equipped pilot met his death. How he did so was for a long time a mystery. He had been flying for some days at San Sebastian. He was using a Bleriot monoplane fitted with the Gnome motor.

Starting away one afternoon after a luncheon which had been held in his honor, Leblon began to make a flight out over the sea. People from the shore watched the progress of the aeroplane for some minutes. It was flying well and everything appeared to be all right. Suddenly, however, as the machine began to make a turn back towards the land, it was seen to swerve, and fall with a crash into the water. At the point at which it fell the water was so shallow that the machine lay just under the surface, resting upon

some rocks. When help was procured it was found that Leblon was lying in his machine quite dead. He had not been killed by the shock of falling, but had, in the doctor's opinion, been drowned.

Subsequent medical opinion advanced an unusual theory. It was that Leblon's accident was due, not to the effect of any wind gusts, or the breaking of any part of his machine, but to a sudden indisposition which overcame him. He had, as has been mentioned, been lunching just prior to his flight. The wind improving, he hurried away from his lunch and began a flight.

The rush through the air after a meal is supposed to have caused him to be overtaken by some sort of a fit. Had this been the case, he would have lost control of his machine, which would have come falling into the water in the way described by those who saw it.

Leblon's death cast a gloom over the flying world for a long time. He was a typically good man, and his loss was very keenly felt. As flying progresses, and as machines become more easily handled, the need for special men to fly them will not be so urgent. But the loss of a pioneer is always a serious thing.

Leblon was the ideal type of pioneer. He was keenly interesting in every phase of his subject. He had an expert knowledge of engines, which is a most important qualification

for any man who goes in for airmanship in its present stages. His motor racing experiences gave him just the knowledge that is required of pace.

To a man who has not traveled fast through the air, the first experiences with a flying-machine are confusing. He feels that he is traveling so rapidly that he can scarcely find time to do all that it is required to do. But a man who has driven a racing motor-car at a speed of 60 or 80 miles an hour does not feel any confusion when he is asked to pilot an aeroplane through the air at a pace of, say, 45 or 50 miles an hour.

In the future, of course, as this need for men trained to high speeds is more emphasized, we shall no doubt have some difficulty in getting pilots who will be able to drive a machine, say, at a speed of anything over 100 miles an hour. But I do not think there will be any very appreciable difficulty in this respect. A man can very easily adapt himself to new conditions. A fact to be remembered also is that the development of speed will be very gradual. This will give men an opportunity of accustoming themselves to the advance.

CHAPTER XIV

THE MILITARY USE OF THE AEROPLANE

As practical tests are of infinitely more value than theory, I am going to describe a very interesting test — to disclose the utility of the aeroplane in warfare — which was made in Blackpool in August, 1910.

The idea, which was evolved by military experts, was to indicate how relief could be brought up from a main column to the advance guard of a force in case of need, an aeroplane messenger being able to pass over any detachment of the enemy's troops which lay between the advance guard and the main body.

The tests were carried out with the active co-operation of Mr. Huntley Walker, chairman of the Lancashire Aero Club. Colonel Grantham, an officer of experience in Indian warfare, drafted out the scheme, and I was able to act the part of the aeroplane messenger, using a Farman biplane which I had at Blackpool, and which was equipped with a 7-cylinder 50-horsepower Gnome motor.

The city of Washington from Mr. Grahame-White's aeroplane, October 14, 1910

The night before the test was made we had a discussion in the Lancashire Aero Club as to the actual military situation which was supposed to have arisen before the aeroplane messenger was called into requisition. At the suggestion of Colonel Grantham, we decided that it would be most instructive if it were assumed that a body of British troops were beaten back by the enemy from the sea at Blackpool to a position at Squire's Gate, some distance from the coast line, and in the center of the aerodrome where flying was in progress.

Here, in a farmhouse, the British force was supposed to be making a final stand. The enemy were imagined to have effected a landing upon the shore and to be pushing as far as possible inland. The English force was assumed to be the advance guard of a much larger body which had established its headquarters at Lytham Hall, a country mansion some 6 miles inland. The owner of this estate, Mr. Talbot Clifton, very kindly co-operated with us in carrying out the experiment.

On the afternoon of the test (Aug. 4) the weather was quite favorable for flying, and I reported to the "General Officer Commanding" at Squire's Gate, who happened to be Mr. Harry Delacombe, one of the officials at the flying meeting, that I was quite able to play my part as that of the "aerial messenger." He told me

that the military situation necessitated an immediate despatch through the air to the headquarters at Lytham Hall. The British force at Squire's Gate was not supposed to be a strong one, and it was reckoned that its position in actual warfare would be hazardous.

Whereupon Mr. Delacombe wrote out for me, quite in a military form, a despatch to be carried to Lytham Hall. It was, I believe, one of the first of its kind; I have preserved it very carefully. The message read as follows:

> "To Commander-in-Chief, headquarters, Lytham Hall, from General Officer Commanding 2nd Infantry Brigade, Squire's Gate. "Enemy has landed from the sea. Have fallen back on Squire's Gate. Occupying white farmhouse. Entrenched and fortified. Can probably hold out for four hours. Reinforcements absolutely necessary. Enemy reported to be in considerable numbers between Squire's Gate and Lytham Hall. This report will be verified by aeroplane messenger. Glad to receive reply stating when may hope to be reinforced."

Folding this up very carefully and putting it in the breast-pocket of my flying suit, I went back to my aeroplane and got Carr, my "Gnome" mechanic, to start up the engine. In a minute or two I was away. The distance between Squire's Gate and Lytham Hall was about 6 miles. The country was of quite of a give-and-take description. There were woods, some hills, also a number of fields, and several

roadways to be crossed. I did a half-circle of the flying ground and set out across country at an altitude of about 300 feet.

An hour previously I had been over the route in my motor-car and had memorized what landmarks there were in order that I should not go astray when flying. I may mention incidentally that the whole experiment was much criticised afterwards, on the ground that I had not ascended high enough when making the flights between the two points.

An enemy was, of course, assumed to be more or less between the British forces at Squire's Gate and Lytham Hall. They were reckoned to have rifles and field-guns with them and to be able to see me acting as aerial despatch-carrier between the two forces. Naturally, therefore, they would have attempted to bring me down by firing at me. At an altitude of 300 feet the critics of the test asserted that I should have offered an exceedingly easy mark.

This I did not for a moment deny, but I was careful to explain afterwards that my height of 300 feet was merely a matter of convenience. The experiment was not to demonstrate whether an aeroplane could be hit or not, but purely to show that it was possible for a despatch to be carried safely and expeditiously across country.

An important factor entered into the question of the height at which I flew. This military ex-

periment was carried out during the progress of a flying meeting. Although it did not in any way interrupt the contests which were in progress, it was not desired, at the same time, that it should last any longer than was absolutely necessary. I knew beforehand that I should have four despatches to carry. Therefore my aim was to pass between the two points as quickly as possible. It meant no loss of time to me to "climb" to a height of 300 feet. I could do that quite easily before I got to the edge of the aerodrome and went out across country. But had I circled round and round to get 1,500 or 2,000 feet high before passing between the two points, it would have added very materially to the length of time each journey occupied, and would have necessitated carrying on the experiments till late in the evening. Having this in mind, and knowing that the test was to be one of despatch-carrying and not as indicating an aeroplane's immunity from gun fire, I considered it quite reasonable to pass from point to point at 300 feet.

But the test afterwards began to assume a good deal more importance than it had done at the time we carried it out. Military experts discussed it in a good deal of detail. While they were quite willing to admit that I had demonstrated the practicability of taking a military despatch through the air from point to point

far more speedily than could have been possible by any means save that of an aeroplane, they one and all seized upon the point of my altitude in order to declare the experiment quite futile.

Therefore, in describing this experiment, I have always made it a point to make it quite clear that it was only a matter of expediency, and not one of compulsion, that caused me to fly at 300 feet high instead of 2,000 feet. My engine was running very well at the time, and there was nothing at all to have prevented my "climbing" 2,000 feet or even 3,000 feet high. In fact, when these criticisms were leveled against me afterwards, I offered to repeat the experiment in a very conclusive way at any time convenient to the authorities.

This project was interfered with by my visit to America, but I hope before long to be able to carry out another test. So far as the aeroplane's ability to act as a despatch-carrier is concerned, any fresh test cannot be more convincing than was the one at Blackpool; but, from a matter of height, it will be possible for me to pass from point to point at any reasonable altitude that is suggested as being likely to give the airman reasonable immunity from an enemy's fire.

After this digression I will return to the actual test we are describing.

Flying across country, I approached Lytham

Hall, an easily distinguished mansion standing in the center of a belt of trees. Passing low over a wood to the left of the mansion, I made a half-circle and landed in a small grass field which had been indicated to me as a good landing ground, by means of a white sheet spread on the grass. Descending quite close to this mark, I remained in my machine, with my engine slowed down, while I handed my despatch to the Commander-in-Chief of the troops at Lytham Hall, who was represented by Mr. Harry Harper, the airmanship correspondent and expert of the London *Daily Mail.*

He read my despatch carefully and questioned me as to my observations in passing across country. I was, you see, supposed to be a "air scout" as well as a messenger. This aspect of aeroplane work cannot be overestimated as to its value, and had there, in reality, been any detachments of the enemy between these two points, it would have been scarcely possible for them to have lurked unseen while I flew over.

The aeroplanist, in flying across country, sees far more than the actual ground below him. Unfolded to him as he flies is a large expanse of country. Apart from that which he sees when he looks directly down, he can command a view of several miles, either in front or on each side of him. It is an amazing thing indeed how small details of a landscape impress them-

selves upon one's mind as one flies from point to point.

After reading my despatch, Mr. Harper gave me one which I was requested to take back to the hard-pressed troops at Squire's Gate. The message read as follows:

> "To General Officer Commanding 2nd Infantry Brigade, Squire's Gate, from Commander-in-Chief, Lytham Hall. Despatch received. Bearer reports about 2000 troops, extended open order, on intervening country. Strong reinforcements advancing immediately on Squire's Gate, and hope to effect your relief within 3 hours."

My return journey to the aerodrome was made without incident and I was able to hand my despatch to Mr. Delacombe, thus having effected a direct communication between the two forces. It is useful to emphasize, should the reader not quite have grasped it, that had we been in actual warfare such communication, augmented as it was by observations carried out in crossing between the two columns, could not have been carried out by any other instrument save the aeroplane.

While Mr. Delacombe was deliberating as to the message that he should next send to his Commander-in-Chief, my mechanics were busy replacing a wire which had broken on my machine.

Then I got away once more, this time bearing quite a long despatch from the troops at Squire's Gate to headquarters at Lytham Hall. This second aerial despatch was couched in the following terms:

"To Commander-in-Chief at Headquarters, Lytham Hall, from General Officer Commanding 2nd Infantry Brigade, Squire's Gate. Your despatch received. Aeroplane messenger reports that enemy's troops concentrating to Westward, presumably with the intention of making combined attack with Naval forces now observed preparing to land. Aeroplane messenger reports three cruisers anchored about five miles west of our position and seven vessels steaming directly in this direction from the southwest, about twenty miles distant. Large landing parties may be expected, therefore, to deliver combined attack within two hours. Trust reinforcement sufficiently strong be sent to intercept attack from sea."

Not only did I carry a despatch, but on this occasion I took aloft with me also a passenger. This aerial traveler did not come with me merely for the pleasure of the trip, but in order that he might demonstrate another very essential aspect of the aeroplane in warfare. Mr. Ivor Castle, who was my passenger, was an expert photographer. He carried up with him a convenient folding-camera, with which it was his intention to secure a series of photographs while we were flying across country in order that he might prove the possibility of the use of such bird's-eye views of the land below when an "air-scout" searches for an enemy's position.

During our flight Mr. Castle, who sat immediately behind me in the small seat which is provided on Farman biplanes for the use of passengers, was able to secure six photographs which were of considerable interest.

One of them showed roads and fields below with extraordinary detail. It would have been impossible for troops to have been lurking along the hedgerows without their presence being revealed in the pictures.

One photograph which Mr. Castle took was illustrative of a farmhouse over which we passed. Here, again, as an indication of what is possible in the way of aerial photography, this negative was unusually interesting. With absolute clearness, taken from an height of 300 feet, the photo showed the farm buildings, the yards around, and also revealed perfectly distinctly the farm hands who had ceased their work in order to gaze up at the swift passing of the aeroplane.

Mr. Castle found no difficulty in pointing his camera in the desired direction while we were flying, and he experienced no difficulty in changing his plates or in resetting his shutter. None of the plates which were exposed showed trace of being blurred through the speed of the machine or by the vibrations of the engine. This photographic test was interesting inasmuch as it demonstrated, quite beyond question, that the camera, when used in conjunction with the aero-

plane, is bound to have a very marked effect upon the future of reconnoitering work in wartime.

Making quite a safe descent with my passenger at Lytham Hall, I gave over my despatch to the Commander-in-Chief, and in a few minutes was able to begin my fourth and last flight to Squire's Gate, bearing the message printed below:

> "To General Officer Commanding 2nd Infantry Brigade, Squire's Gate, from Commander-in-Chief. Despatch received. Aeroplane messenger's passenger has been able to describe to me exactly enemy's present disposition. We shall probably be in touch with enemy before you receive this."

I reached my starting-point without accident and, giving over my despatch to Mr. Delacombe, was able to complete the test, so far as the reliability of my machine was concerned, with complete success.

I may go back a moment, however, to describe the impression of his flight which was given by my passenger, Mr. Castle. He was enormously impressed by the clearness of the panorama displayed below as the aeroplane passed across country. Further than this, he was amazed to see how easy it was, after he had descended, to remember the features of the landscape over which he had passed. This led him to make a remark which struck me as being very interest-

ing. "Things one sees," he said, "are almost photographically impressed upon the eye."

Mr. Castle was emphatic in the belief that had troops been lurking anywhere on the tract of country over which we passed it would have been impossible for them to have escaped his observation.

This completed the practical part of the experiment. It only remained for the generals to decide what value the aeroplane had actually been. It was assumed, of course, in estimating this, that the conditions had been those of actual warfare. Judging the results obtained in this practical way, it was decided that the aeroplane messages would have exercised a very important effect upon the situation had an enemy's operations been in progress. To begin with, bearing despatches over a portion of the country occupied by an enemy would have been out of the question save by such means as I provided. Having effected this, it was clear that the small force at Squire's Gate would have been relieved by the pushing forward of the main forces at Lytham Hall. Thus, a reverse would have been obviated. Such a result, achieved under conditions which were quite ordinary, and with no special type of aeroplane, is, I think, sufficiently convincing to make any thoughtful person realize that in nearly all operations of the future the aeroplane will play a very important part.

CHAPTER XV

THE MILITARY AEROPLANE

Let me now consider the type of machine which is to become of practical use for reconnoitering work in time of war. None of the aeroplanes which we possess at present is entirely suitable for this purpose.

Some of those which have been used in tests have not been able to take up a passenger. This means that the pilot must, in addition to controlling his machine, be called upon to make observations and mental notes of what he sees below him, while passing through the air.

Although this can be done, and has indeed been done by biplane pilots who could have taken up a passenger had they cared to do so, such a method of observation is not a thoroughly reliable one.

It seems to me quite clear that, in any scientific method in aerial reconnoitering, the pilot of the machine must be left to control his craft without having anything else to do, and that the notes and map-studying must be carried out by a companion, specially trained for the work.

Thus we have some idea of the type of machine that will be necessary before aeroplanes can be built, as a standard, for military requirements. It has been represented to me, by more than one military authority, that the really ideal aeroplane for work in war-time should be able to carry three people as its regular "crew."

If this machine can be made, and there is no question at all about this, the three people on board would have their duties allotted to them in the following way: The pilot would have nothing to do but steer his machine, and attend to the engine. A second man would act purely as the commander of the aeroplane. That is to say, he would arrange, beforehand, a tract of country which was to be reconnoitered, and would sketch out upon his maps just which route was to be followed.

Once the machine was in the air, this captain would direct the pilot as to the course he was to fly. He would tell him to ascend or descend, or turn to the right or left according to his (the commander's) idea as to how best the reconnoitering work could be done.

The third passenger would be the actual observer or note-taker. This officer, with his maps and note-book to hand, would not only plot off the aeroplane's course upon his map as it flew over the country, but would be responsible for all the notes made regarding the observations of the trip.

To his lot, for instance, would fall the drawing of a diagram illustrating the position of a squadron of the enemy's cavalry. He would also, perhaps, have to follow out upon his map the course of a river. In addition, no doubt, he would be called upon to make comprehensive notes of the whole lie of the land as the aeroplane passed over it, so that he might, when returning to headquarters, give a description to his commanding officer of the exact nature of the country which lay between his forces and those of the enemy.

It is obvious, surely, from this brief sketch which I have given, that it is impossible for the pilot of an aeroplane to fly his machine satisfactorily, and to carry out aerial observations as well.

The crew of three, upon a military aeroplane, certainly represents as near perfection as one could imagine. You have a pilot, with nothing to do but concentrate his attention on the direction of his craft. In a wind, for instance, this would be absolutely essential.

It is only on a perfectly calm day that an airman can dare to remove his thoughts, for an instant, from the manipulation of the hand lever which operates his elevating plane and balancing planes, and the foot rod which — swinging from side to side on a pivot — permits him to turn his rudder like that of a ship.

In a gusty wind, an aeroplanist needs to be as

Mr. Charles Foster Willard and Lieutenant Fickel in a Curtiss biplane

watchful as a cat. As the gusts strike his machine, it turns from side to side, sways over, and plunges as well. How much motion there is in an aeroplane in a wind people scarcely realize. More than once, when struck by a heavy gust, the aeroplane has made so rapid a drop that the pilot has almost been thrown from his seat.

As a matter of fact, in such work as aerial reconnoitering, which may very frequently have to be undertaken in adverse weather, it is vital that the pilot should be left entirely undisturbed to the control of his machine.

All that is necessary for him to do is to obey the commands of the officer who, having nothing to do but to direct the course of the aeroplane, is most fitted to choose the best course for the work in hand.

As regards the third member of the crew, the actual observer, his work will, it can be seen, be sufficiently arduous. To be of any use to a general commanding troops, the work of the air-scout must be undertaken very painstakingly and very thoroughly. What reports are brought to hand must be comprehensive and accurate, particularly as regards the disposition of troops that are seen.

For this reason again, it is clear that one man, and one man alone, must be responsible for the actual observation work, although, in case of doubt, there is no reason why the observer should

not turn to the commander of the aeroplane, and seek to verify some observation that he has made.

Photography, of course, enters very largely into the possibilities of this kind of work. There are occasions, I can foresee, when the camera will be very useful; but in rapidly conducted reconnoitering work, where the aeroplanes sent out will have to return immediately to headquarters, the observation conducted must be communicated by word of mouth, by the marking upon a map, or by diagrams roughly but clearly drawn while in the air.

In this respect, of course, training will be necessary before anything like perfection is reached, and it is in this aspect of airmanship that nations have so much to do. And yet, among many military authorities, I have not observed an appreciation of the amount of what one may call the spade work which has to be done before the aeroplane reaches its full use as a war weapon.

In the aeroplane demonstrations which, on a very limited scale, were introduced into the last autumn maneuvers in England, there was no attempt, beforehand, to get any officers trained to act as observers upon aeroplanes.

The result was that the pilots themselves, who were not thoroughly acquainted with the work of reconnoitering, were called upon to do the best they could.

It is in such carelessness as this that the aero-

plane loses its value. As it requires the greatest skill to fly an aeroplane with safety, so it will require a great amount of systematic work to make full use of aerial craft in time of war.

The amount of preparation that will be necessary before any army can regard its aeroplane service as being satisfactory is not properly realized. Not only will it be necessary to have a corps of specially-trained pilots, but there will need to be trained a body of officers thoroughly acquainted with the technicalities of the aeroplane, one of whom will be appointed to take charge of each machine.

Then will come the observers, who can only be trained to a high state of efficiency by making innumerable aerial trips, and by thus studying, in a practical way, the duties they will have to perform.

Nor will this be all. There will be need for a special corps of mechanics, thoroughly conversant with engines, and with the other gear of aeroplanes. They will be in charge of whatever repair work is necessary. In a campaign it will be quite a science in itself to see that the spare parts necessary are brought quickly to the spot where they are needed. I can foresee myself the designing of special motor vehicles containing assortments of engine parts, spare struts, wires, etc., which will be driven from point to point in pursuit of the aeroplanes which are in service. Thus, if

an aeroplane comes to grief, it will be possible for the repairing vans to be quickly on the spot, and for the machine to be put in trim again with a minimum of delay.

It is perfectly obvious to me, even in this earliest stage of development, that it is futile for any government to go half-heartedly into the problems of flight. The army which has a certain number of aeroplanes, without their equipment and use being scientifically studied, will find that their air-corps will fail them when the time of need comes. And, on the other hand, the Power which enthusiastically prepares to make full use of its air service will find itself more than repaid by so doing.

You can imagine quite well what will happen one day, in actual warfare, when the aeroplane is called into practical use. You can picture a general holding a position and being uncertain whether to advance or retreat until he knows exactly how the enemy confronting him is disposed. He wants to know, for instance, whether it is upon the position immediately facing him that the enemy is concentrated. He desires to find out what their cavalry is doing, and also where their artillery is moving.

So what must he do? He calls up the officer who is in supreme charge of the air corps. This officer, by the way, will be a very important person. He will not need to concern himself with

minor questions affecting the use of the aeroplanes, but will be thoroughly acquainted with their disposition from day to day, what pilots are immediately available, and also whether the climatic conditions prevailing at the moment are suitable for aerial reconnoitering. To this officer the General will convey his requirements. He will explain that he wants the whole of the enemy's position reconnoitered, and as complete a report as possible presented to him with the minimum amount of delay.

What this may mean can be understood, perhaps, when it is remembered that in more than one case, in recent history, a battle front has extended for a distance of more than 50 miles.

After receiving his instructions the commander of the aeroplanes will call up the officers who are in control of a machine. It can already be seen how readily organization enters into the use of aerial craft for military work. To the officers in charge of the machines their commander will explain what section of country has to be observed.

He will study a map with the officers in charge of the aeroplanes, and will sketch out the area which the reconnoitering aeroplanes will have to cover. This point being clear, each officer will return to his aeroplane and show the observer, upon his map, what the actual work in hand is to be.

Then the pilot, having taken his seat, and the mechanics having stated that the mechanism of the machine is in perfect order, the air-craft will soar aloft. Each machine will set out to reconnoiter its own particular tract of country.

Here, again, you see the power of organization illustrated. Without such organization it will be impossible, in any future warfare, to make a complete reconnaissance of a large stretch of country — only a part of which may be occupied by the enemy's troops.

The evolutions of the aeroplanes, while performing their reconnoitering work, will be extremely interesting. The first aim of the pilot, before setting out over the enemy's country, will be to attain a considerable altitude. Although his height will be largely governed by the specific work which is in hand, it is generally conceded that aeroplanes will fly at very considerable altitudes when they are in any danger of coming within the reach of gun-fire from an enemy.

Col. J. E. Capper, who is one of the greatest authorities upon aerial warfare in England, says that he does not imagine that an aeroplane, when actually passing over an enemy, will find it safe to descend below an altitude of 5,000 feet.

That effective reconnoitering work can be carried out at this altitude has already been made clear. Of course, in cases where the observer cannot be absolutely certain that what he sees

below is, say, a squadron of cavalry, the pilot will be asked to make a swift descent to a little lower altitude, and then to mount quickly again, in order that a more detailed view can be obtained of the land below.

The employment of a number of aeroplanes to carry out reconnoitering is advisable, seeing that a large tract of country can be more quickly observed if a large corps of machines are distributed over it; and it is quite clear that in the majority of cases a commander-in-chief will desire to have information brought to him as speedily as possible.

The advantage of being able to distribute a number of machines over a wide tract of country is that, whereas a good many of them may draw blank and return without news, there are sure to be one of two which will provide information of a valuable nature.

When each aeroplane has completed its reconnoitering trip, it will return to its headquarters. Then, when all the machines are back in their places, the officers in charge of them will have a consultation with their commander. Each officer from the aeroplanes will have his map. Upon this map will be indicated the positions of any troops which have been detected during the aeroplane's voyage.

In addition, the observer from each of the machines will have his notes as to the character

of the country passed over. In this way, after only a brief talk with the men who have carried out the actual observation work, the officer commanding the aeroplanes, who has not himself left the ground, will be in possession of a full description of the enemy's position and movements.

Then, when he has made himself acquainted with every detail of the report, and has sketched upon his own map the salient points presented to him, the officer commanding the aeroplanes will seek the Commander-in-Chief.

Such systematized work will quickly show its value. A Commander-in-Chief, for example, who is busy with a hundred details of a battle, will never find time to cross-examine the pilots and officers in charge of a dozen aeroplanes.

All that he wants to know is what has been seen over an appreciable tract of country, and whether his own deductions as to the disposition of the enemy's forces are correct or not.

It is to provide him with this information, as much curtailed as possible, that the officer commanding aeroplanes will first sift the news brought back to him before presenting it to the supreme authority. With his map ready to hand, and the notes of the observers conveniently penciled down, the chief of the air-corps will be able to lay the position before his superior officer in the space of only a few minutes. Such information as this, precise and to the point, will surely be invaluable.

In connection with the reconnoitering of an enemy's position by a number of aeroplanes, the question arises as to what damage will be done to them by the fire from the enemy's guns. Here, as a practical pilot, I think I may be able to make some observations which are of value. It should, in my opinion, be possible for a reconnoitering aeroplane to do the great part of its work without coming within range of an enemy's guns. Given a clear day and the ability to rise to a considerable altitude, and granted also that the observer is able to use his field-glasses with effect, I am quite sure that all the information necessary, regarding an enemy's lines, could be procured without imperiling the lives of the observers. Of course, there are many points like these which can only be proved by actual warfare.

But what I want to make clear is my belief that during the time that the reconnoitering aeroplane is carrying out its work, it will not, as some critics aver, be subjected to a hot fire from an enemy's guns. In a great many cases, I foresee, the enemy will never be aware of the fact that their position is being reconnoitered from the air. In other cases, I can also see, the enemy's gunners will observe nothing but a speck in the sky, in the far distance, to represent to them the "eye" of their foe.

Naturally, seeing that we are dealing with such a thing of war, the inevitable is bound to happen.

Some martyrs are bound to give up their lives in the service of their country. When large numbers of aeroplanes are sent out, it is certain that some proportion of them — what proportion no one is in a position yet to say — will be struck by enemy's shells.

What will happen to an aeroplane when "winged" one can scarcely say. If an essential part of its sustaining or controlling gear is destroyed there will be nothing to save its crew from destruction.

From rifle fire there will not be so grave a risk. It will be possible to hit an aeroplane with bullets, in many cases, without bringing it to the ground. For the reason that they will thoroughly appreciate the vulnerability of their craft, the crew of an aeroplane will seek, with all their skill, to find out as much as they can about an enemy's position without offering themselves as a target to the guns below.

A much debated question is the vulnerability of the aeroplane when assailed by gunfire from below. Upon this problem there is really no very definite data as yet to hand. Gunners, as one might expect, declare that they have no doubt at all but that the aeroplane can very easily be hit by means of a special gun, even when flying very high and very fast.

But, in proof of these contentions, which are very generally made by experts upon artillery,

there are no practical tests forthcoming. I know personally of several experiments which have been made to see whether an aeroplane can be struck by shot or shell. In one of these tests, made in France, kites were sent up to represent the aeroplanes. On the ground, towing these kites, were a number of motor-cars.

The kites were moved through the air at a speed which, when their height was taken into consideration, was reckoned to represent a rate at which an aeroplane would be traveling. Firing at the kites were a number of picked gunners, using field-guns.

The actual record of hits and misses is not definitely known. As a matter of fact, the results attained were not given out. But I heard, on quite reliable authority, that the gunners failed altogether to establish their claim that an aeroplane constitutes an easy mark. Of the series of shots fired the majority went quite wide of the kites, and those which were successful reached their target rather more by luck than by the marksmanship of the men behind the guns.

This result, although it cannot be described as conclusive, was certainly interesting. It must be remembered that, in firing at these kites, the gunners had a good deal to their advantage. The kites were not moving at the speed of an aeroplane when flying fast. Neither were they moving from side to side as an aeroplane pilot would

be when he knew he was actually under fire. Therefore, in actual practice, it would have been much more difficult to hit an aeroplane than it was to make good practice at these kites. The few hits which the gunners registered, when aiming at the kites, would scarcely have been made had they been leveling their guns at an aeroplane flying past them.

Another test — in which a good deal of interest was evinced not long ago — was carried out in Germany by a number of German experts. In this case, instead of using kites, a number of balloons were employed. These balloons were not large ones, of a passenger-carrying capacity, but were miniature spheres filled with hydrogen, and painted black. When the gunners were ready to fire, these balloons were released, one by one, and allowed to float upwards to a specified height before any artillery was discharged. The heights the balloons attained, and the distances they were away, were carefully calculated, as was the speed at which they were traveling.

Here again, I am informed, the results obtained were all in favor of the aeroplane. Through the movement of the balloons, and the unexpected nature of the work they were asked to carry out, the gunners did not accomplish what they were expected to do. In fact, the hits they registered were very few and far between.

In this case also, the conditions favored the ar-

tillery. So here we have two tests, more or less useful, in which the theory that an aeroplane can be easily hit by gunfire was not substantiated. There is a third experiment, of which I have received tidings, which was conducted by the British Admiralty not so very long ago. Regarding this, however, no very conclusive news has leaked out. From one authority I have heard that the target fired at was hit many times. From another, on the other hand, I learn that the gunners did not succeed in getting many hits.

The target, in this case, was a large kite constructed roughly to represent an aeroplane. It was towed by a torpedo-boat at a certain distance out to sea. As it passed a battery, the gunners opened fire upon it. Here again the conditions were greatly in favor of the battery. It is much more easy to hit an object which is moving forward in a perfectly straight line than it is to aim correctly at an aeroplane moving in curves or circles or darting up and down.

Suppose, for the sake of argument, that an aerial scout has to come so near an enemy that he is actually subjected to their fire. Directly he sees that he is actually in danger of being hit, his plan will be to make himself as difficult a target as possible.

What will he do therefore? He will turn rapidly either to the right or the left and he will also climb quickly in order to plane down again. Thus

he will make himself an exceedingly difficult and puzzling target. Such evolutions will, without doubt, materially increase the difficulties of a gunner when asked to shoot at an aeroplane. Another point must be taken into consideration also. This is, that the aeroplane will become, as it improves in speed, even more difficult to hit. The present calculations of military experts, when they say that an aeroplane can be brought down by gunfire, are that this machine will not be traveling at a pace of more than 40 or 45 miles an hour.

What will happen in the near future, however, is, that aeroplanes will be traveling, not at 45 miles an hour, but at 80 and even an 100 miles an hour. The difficulties of a gunner, under such circumstances, can easily be understood. Whether a gunner will be able to hit an aeroplane which is traveling at a speed of 100 miles an hour, at a height of 5,000 feet, it is, of course, impossible to say, because no tests bearing upon such a question have been made. But it seems to me that its speed, and the small object that it will present at such a height as 5,000 feet, will make the aeroplane an exceedingly difficult mark even for the most expert gunners provided with special weapons for shooting at aerial craft.

A great deal of work has, of course, been done in the way of building special guns for the destruction of aerial foes. So far, enterprise in this

direction has chiefly come from Germany. The great Krupp works, for instance, have produced several guns, some large and some small, with their barrels so arranged that the sky can be quickly sighted in any direction.

Science has also progressed to the extent of fitting such guns upon motor cars, so that they can be moved quickly from point to point. But the tests of such weapons, under entirely practical conditions, are not yet forthcoming. Until they are — and it will not be until warfare comes that actual experiment can be made — the whole question of the vulnerability of the aeroplanes must remain more or less of a mystery.

On the one hand we have the opinion of some of the most expert of military authorities, who say that, given specially trained gunners and a weapon designed solely for the purpose, they can guarantee to bring down an aeroplane flying at a considerable altitude with a certain amount of ease. Supporting their contention, however, is no practical proof.

On the contrary, what tests have been made certainly go to prove that an aeroplane would afford a very poor target indeed. Pilots themselves and those who have studied this question with more or less of an impartial mind, have no hesitation in declaring that the aeroplane, skillfully handled, would baffle the most expert gunners the world can produce.

It is significant to note that, in all the conversations I have had with military experts, the point of the destructive possibilities of the aeroplane has not been touched upon.

By general consent, I think, the opportunities which the aeroplane may offer for bomb dropping or shooting from above are left to be determined by practical tests after an air corps has demonstrated its ability to carry out observation work in a satisfactory way.

More than one military authority who has briefly touched upon bomb-dropping by aeroplane has told me that he thinks there is very little in this aspect of flying.

Another, I remember, far more open-minded, observed: " Of course in picturing what an aeroplane might do in a destructive way, one has to deal with the present-day machines rather than with those of the future.

" Uses I foresee for the aeroplane as a destructive instrument are at night, or in connection with attempts to destroy such things as powder magazines, special buildings, or isolated forts. It seems to me that, even with the limited amount of damage that a present type of aeroplane could do, the moral effect of a night attack, delivered by such machines, would be very great.

" One can for instance imagine a number of aeroplanes setting out after dark and discharging bombs over an enemy's position. It would not be

the actual destructive effect of such bombs which would count, but the panic which might result from the sudden attack from the sky.

"It is clear, of course, that soldiers would soon lose their fear of aerial foes. This has been shown in connection with almost all the new war weapons that have been introduced. For a time, for example, a new form of explosive has produced a 'panicky' effect upon the men encountering it for the first time.

"But to anything, however deadly, it is human nature to be accustomed. Therefore it must be taken for granted that troops in modern warfare will soon lose their fear of the aeroplane. In cases where the dropping of one or two bombs will have a destructive effect, I foresee that the aeroplane will be exceedingly useful. But during the din of battle, when shot and shell are falling fast, I do not think that the bombs from an aeroplane will have very much definite effect; and it must also be remembered that, in order to make effective aim with any method at present known or suggested, an aeroplane would have to descend fairly near to its target in order to make good practice with its bomb dropping. In doing this it would subject itself to a probably deadly fire from below. Taken all round, I do not foresee any very serious use for the aeroplane as an instrument of destruction — at any rate for some time to come."

This opinion struck me as being a very fair-minded one, although I, as an airman, did not quite agree with the view that the aeroplane's destructive work is so limited, even at the present time.

Frequently, at flying meetings, I have made tests to determine how it is possible to drop bombs from an aeroplane in flight. At Blackpool, after having had the shape of a battleship whitewashed on the aerodrome, I ascended to the height of a little less than 1000 feet, carrying with me a basket in which I had placed some 20 composition balls which were supposed to represent bombs. Passing to and fro over the outline of the battleship I endeavored to drop them as near the center as possible.

Although this was practically the first time I had made such an experiment, I discovered that taking aim even, for a beginner at such work, was not as difficult as had been stated. I forget exactly how many hits I made, but I know that everybody was surprised at the accuracy of my aim.

A thousand feet, of course, was not very high to be flying for such a purpose, but I have no doubt that, with a little practice, it would be possible to release bombs from an aeroplane in flight with very good effect.

Of course, a point to be considered is the weight of explosives it would be possible to take

up in the air with one. In this relation, one's capabilities are limited owing to the lifting capacity of present-type aeroplanes. But I am sure a pilot in war-time would be able, upon occasion, to make the aeroplane a very definite engine of destruction.

It seems to me that one of the most useful ways to employ the aeroplane for destructive work would be to send it out to make a night attack. Not only would such a project have the effect of alarming an enemy, but an aeroplane attacking by night would run much less risk than in the daytime of being struck by shell.

There would not be many occasions, however, upon which an aeroplane could be used as a weapon. It is true, generally speaking, that the most useful work will be done in the way of aerial reconnoitering. But it must be remembered that the present-type machines are only in their infancy. Although, with such machines, observation work is easy, they certainly fail somewhat when regarded from the point of view of primitive work. As the machines progress, however, their importance from an offensive point of view is bound to increase. When we can get a machine which will carry a dozen people, and fly at the pace of 100 miles an hour, the margin allowed for weight-carrying will permit bombs and guns as well to be carried aloft.

A high-speed metal-built aeroplane, well ar-

mored from fire from below, and carrying a special form of quick-firing guns, will play a very important part in warfare of the future. But that may be looking ahead for some years.

What we must realize is this: if a war broke out quite soon, and even if aeroplanes improve no further than we at present know them, they would prove an invaluable "arm." Therefore, no Government can afford to be without them. It is a mistaken policy, too, for any War Office to say that they will wait and see what other nations are doing.

Although it is easy enough to copy some aeroplane, when one has the facilities, it is not possible to create, in a short time, the whole equipment of men and mechanical devices which will go, in time of actual war, to make the aeroplane a really efficient auxiliary.

It is a case of anticipating, rather than of waiting to see what use an aeroplane can actually be. What every country ought to do is to prepare for the future. Machines of all kinds must be experimented with. Officers specially told off for this work must be gaining experience from day to day so that they may be ready at any time to make full use of any opportunities that may arise for an effective use of the aeroplane as a despatch carrier or as a machine for carrying out observation work.

One very important aspect of the use of the

aeroplane in war is the fact that its cost will be very low compared with the work that it will be able to perform.

This feature of aerial work is not properly understood, particularly by military experts. A whole corps of machines could be built at a very low cost. A machine bought in the ordinary way costs its purchaser, say, from nine hundred to a thousand pounds. There is little doubt but that a number of machines for military use could be built in Government factories and equipped with engines at a price of less than £600.

When it is remembered that, in a campaign, any one of these machines might have the power to alter the whole course of an action by the news it brought in, one cannot consider this cost to be a high one. This point, too, has importance in regard to the question of the destruction of machines. When a country can obtain a fleet of aeroplanes at the low cost the loss of one or two of them — apart altogether from the question of the loss of human life — is not a very important one.

It is interesting to note, in connection with the development of military airmanship, that a great many manufacturers are seeking to produce an aeroplane specially designed for war purposes.

In this connection, one may say, without contradiction, that none of our present-type aeroplanes are entirely suitable for military purposes.

What are the essentials for this special work? In the first place, the aeroplane must be unusually strong. In the second place, it must be very portable. In the third place, it must be highly efficient.

These three requisites are not easily combined in an aeroplane. With the idea of furthering the construction of such a machine, the French government is offering very handsome prizes. Their experts explain exactly what they require in the way of a military aeroplane.

One of the most significant demands is that the machine should be able to land in, and rise from, a plowed field. Such a machine does not, of course, exist at the present time.

The most practical form of landing chassis is a clever combination of wheels and skids. In the early days of flying, this question of landing proved to be one of the most difficult.

The Wright brothers, after considering it carefully, produced a machine which landed upon two skids. This was found to be quite efficient. But the difficulty with it was, that the machine could not be launched in the air, when starting a flight, without the assistance of a stretch of rails. Along these rails the machine ran, on a little carriage. When the end of the rail was reached, the carriage automatically fell away from beneath the machine, which then had sufficient speed to rise on the air.

Apart from the simplicity in construction which this device offered, it was possible to lighten the aeroplane appreciably by not fitting any wheels to it. But one very conspicuous disadvantage of this system was apparent.

Wherever the machine was taken, here also the starting rail had to be carried. At the early aviation meetings, when all the flying was done from one spot, this disadvantage was not so apparent. But as soon as the reliability of their engines permitted pilots to make long cross-country flights, the inconvenience of the rail-starting system was quickly seen.

Then it was that a landing device was built in which the skids of the Wright brothers and the wheels of the other early type machines were combined.

A word should, perhaps, be interpolated here to describe the first landing devices in which wheels alone were employed. One finds a typical instance in the Voisin biplane. Here, mounted on a carriage of metal tubing, were two very strongly-made bicycle wheels, fitted with pneumatic tires. Enabling them to withstand the shock of a sudden descent upon the ground, these wheels were attached to springs which permitted them a good deal of elasticity when the moment of contact with the ground came.

In this connection many people seem to imagine that the shock, when an aeroplane returns to the

ground, is far more violent than is really the case. When an aeroplane is skillfully piloted back to earth the weight upon the landing wheels at the moment it touches the ground is remarkably small. What happens, of course, is that, until its speed is very greatly reduced, the sustaining planes of the machine are performing their work, as they do in the air, and are holding up the weight.

Thus, at the moment of contact, the running wheels are called upon to support only a very small proportion of the total weight of pilot and machine. But it is not for good landings alone that the chassis of an aeroplane has to be designed. Abrupt and heavy landings are very frequently made. When they occur, the strain upon a landing chassis is very great.

And there is a great deal of importance attached to the landing devices of aeroplanes for a very good reason. In the majority of cases, when the chassis of a machine does collapse, the greater portion of the aeroplane is wrecked. How this happens may easily be understood. As soon as the chassis collapses, the main planes are allowed to strike the ground with disastrous results. The breakage of the chassis generally means an abrupt stop, when traveling at a high rate of speed, which has a shattering effect upon the whole structure of the machine.

Tests which were made with the first of the

wheel type of chassis showed that it was quite efficient when subjected to nothing more than ordinary shocks. But, when a violent landing was made, it was discovered that it was difficult to construct a wheel form of chassis which would be sufficiently strong.

The wheels frequently buckled under any severe strain. They were particularly vulnerable, also, to the effects of a landing made sideways. As soon as the sideway shock was applied to one of them, it buckled up.

The effect of this was to wreck the machine. What happened was this: The axle, unsupported by the broken wheel, stuck into the ground. This turned the whole machine over sideways, and very little was left of it. As a rule, in these smashes on the ground, the pilot escaped uninjured. His position near the center of the machine generally gave him immunity.

This difficulty with the wheel type of chassis led Mr. Henry Farman to go very seriously into the question in the early part of the summer of 1909. The result was a form of chassis which has not yet been surpassed in point of practicability.

Below the center of the lower main plane of his biplane, supported on uprights, were placed two long wooden skids. Attached to each of them, in an ingenious way, were two small bicycle wheels, one on each side of the skids, and joined

together by a short axle. Holding this axle to the skid was no rigid device. Instead, several elastic bands were passed over the axle and firmly attached to the skids.

The result was a shock-absorbing device of a particularly efficient nature. In operation this clever wheel and skid device acts in the following way. In an ordinary smooth landing the wheels first meet the ground, and rise very slightly against their rubber supports. Then the rear edges of the skids touch the ground, and act slightly as a brake, gradually bringing the machine to rest.

In heavy landings what happens is this: the wheels are forced up against the rubber bands, and the skid between them comes into contact with the ground, taking the more violent shock of the contact. Then, with a rebound, the wheels come into play again and the machine runs along the ground until its momentum is exhausted.

It is possible, with the Farman type chassis, to make landings upon fairly rough ground. But it is a fact also that no chassis yet designed will permit anything like a safe landing to be made on very rough ground.

Yet this is what the military authorities demand. Their view, naturally, is that an aeroplane might, in the exigencies of war, have to descend in a plowed field, or upon some quite uneven piece of land. For such a machine to be unable

to rise again, after such a landing, would mean that it would have either to be destroyed, or allowed to fall into the hands of the enemy. The practicability of a landing device is, as a matter of fact, one of the most important features of a military aeroplane. How it is going to be made possible for an aeroplane to ascend out of a plowed field it is difficult at the moment exactly to determine. But some of the clever constructors are working at the problem; and one of them told me, only the other day, that it will be solved.

The ability of an aeroplane to rise into the air more quickly than is at present the case will have a material effect upon getting away from bad ground. It is possible, I foresee, either by having a method of moving propellers up and down, or by altering the angle of one's planes, to get into the air very much more quickly than is at present the case. If this can be done, and with a chassis designed specifically for rough work, I cannot see why the plowed field test should not be successfully carried out before the end of this year.

Even what can be done at present, in the way of quick rising in the air, is very remarkable. At Blackpool, during last summer's aviation meeting, I was able to rise into the air, from a standing start, after moving across the ground for only 20 feet 9 inches. In fairness, however, it should be stated that this remarkably short run was achieved very largely by starting against a con-

trary wind. In the ordinary way, 25 or 30 yards is a fair distance for a pilot to run along the ground before he has attained sufficient speed to rise into the air with a biplane. As regards a monoplane, better results are attained, a machine frequently leaving the ground after a run of only 15 yards.

A highly important aspect of the military aeroplane is its portability. In war-time what the experts desire is a machine which shall be carried from point to point, following the troops without inconvenience or delay.

In discussing this matter with me not long ago, one of the greatest experts upon military transport said: "I will tell you the sort of aeroplane we want from the point of view of transport, and not of flight. We want a machine that can be loaded up on a big motor lorry. With it, on the same lorry, will have to ride the aviator and two or three skilled mechanics.

"When the machine has been brought to the point from which it is to be flown it will need to be put together very speedily. I foresee the sort of machine that can be packed away in a big crate, and this crate clamped upon a specially-built lorry. I should imagine that the planes of the machine will be fixed to the sides of the crate inside, and that the engine, and other gear, will occupy the middle portion of the crate. The test will come, of course, when the mechanics start to put the machine together.

"The ideal to be aimed at, in this respect, is that the machine should be put together in about half an hour. The quickest time for this assembling work so far is, I understand, about an hour and a half. Such a period, however, would be too long for the assembling of an aeroplane urgently required for reconnoitering work. I know, of course, that this quick assembling is not easy. It means some form of construction in which wires are not so freely used as is at present the case. The skill of the mechanics, in doing their work, would naturally enter very largely into the matter. I see, of course, that the difficulty of carrying such a machine from point to point on a motor car is increased by the fact that it needs to have sufficient lifting surface to carry 3 passengers.

"But there is, surely, no reason why some form of construction should not be adopted which will permit the planes of a machine to be arranged in sections, which can easily be joined together when the machine is required for use, and yet which can be stowed away in a small space when the aeroplane is being transported from point to point. There is no reason, either, so far as I can see, why it should not be possible eventually for some telescopic plane to be devised. If such a form of construction should prove possible it would, of course, have an extremely important effect upon problems of transport.

"I, and others as well, see that we are setting

the aeroplane manufacturer a very serious task in fulfilling all our requirements. We must have a machine that is portable. We must have a machine to carry more than one person. We must, also, have a machine which is highly efficient. It is also essential that a military aeroplane should rise quickly into the air and climb fast to any desired altitude.

" More than one manufacturer has told me that one demand negatives the other. It may do so in the view of those who do not think that the military aeroplane is likely to be evolved very soon. But, in my view, it will not be long before the machine we desire is to hand. The builders of aeroplanes have every inducement to persevere in their attempts to produce the ideal machine for military work. Once the machine we want has been made there will be a very large demand for it. Besides, their experimental work in producing such a machine will be of the utmost value to the manufacturers in making designs for aeroplanes of general utility."

This expression of opinion is interesting and instructive.

CHAPTER XVI

AN EXPERT MILITARY OPINION ON THE AEROPLANE

I think it would be interesting to add to what I have written myself upon military flying an expression of opinion, which has been very kindly written for me by a military officer who has had a great deal of experience both in the field and also at flying meetings. This officer has, in fact, studied the aeroplane from the point of view of its military significance for at least two years and has assisted in the carrying out of a great many tests to prove its value. What he says is this:

"In the various army maneuvers which have so far been held the aeroplane, although its application has not generally been well organized, has proved of very great interest. It has, indeed, demonstrated one or two very interesting points. On many occasions I have heard critics declare that Governments, and particularly officers in command of troops, are pig-headed and disbelieving so far as the possibilities of the aeroplane in warfare are concerned.

"Here, however, there is a very considerable misapprehension. I have talked with officers of great distinction and experience as regards the use of aeroplanes in an action. I have also had the opportunity of deciding pretty accurately what the views of a great many other well-known men happen to be.

"There is not, I am convinced, anything in the nature of real apathy on the part of those who are responsible for what one might call the administration of war. Not one of the authorities with whom I have spoken have made light of the aeroplane. Not one of them so far as I can remember has raised anything that one might describe as a foolish or prejudiced objection.

"What I am sure of is that those people who have been advocating, day in and out, the use of aeroplanes in war have been, to a very marked extent, doing their own cause harm. This may sound rather a strange statement, so I will explain it. A great deal of foolish argument has been employed with the purpose, apparently, of forcing the governments of various countries, and particularly of England, to adopt the aeroplane on a large scale. Deputations have waited upon ministers. A great many foolish articles have been written in newspapers by men who have not had a thorough grasp of their subject. There has been an attempt, so far as England

is concerned, to create a panic. The Government has been held up to scorn for its lack of enterprise, and one or two other campaigns have been embarked upon which have done little good towards the object desired and have, as a matter of fact, checked progress to a great extent.

"Ministers of War cannot very well allow themselves to be forced into the adoption of the aeroplane without giving the whole question of aerial warfare the very closest consideration. Once or twice, after a notable flight has been made, there has been an outcry as to why the War Office has not provided the country with an aerial fleet. Such arguments and 'scares' have not moved the authorities at all. It would have been far better had the people who have written and spoken so much moderated their views a little and waited to see what was actually going to be done.

"To begin with, the authorities in England, and elsewhere as well, have felt a good deal of diffidence in approaching this question of aerial warfare. In no field of experiment is a greater sum of money to be spent, and in no path of research is less result very often to be shown for it. In comparison with what France has been doing, we in England have lagged very much behind. But the theory is, in this respect, that leeway can, up to a certain point, be very rapidly made up, once it is seen that there is

a clear line ahead for development. The idea that one may make up lost ground quickly is, I know, one which is very largely questioned by those experts who say that England should have proceeded in the matter of flying step by step with such a country as France. Undoubtedly, the policy in England has been to see what others have been doing before embarking upon any definite line of construction ourselves.

"It was not long ago that I had the opportunity of explaining to a very high authority what people said regarding the policy of what was called by one critic who came to me— 'wait and see.' People declare, I explained to this high authority, that when we consider the time is ripe to build a number of aeroplanes and equip our forces with a regular aerial arm, we shall find ourselves unable to produce as efficient a department as that of a country which has been working in this field for several years. What is meant by this, I think, is that the experience gained by these early experimenters will tell so greatly in their favor that even when we can match them in the way of apparatus they will still be ahead.

"To this remark of mine the high authority with whom I was speaking replied: 'War has become a very complex affair.' So complex is it, indeed, that there are many new aspects of it that can scarcely be understood even by

those who study them very carefully. That the aeroplane will, sooner or later, introduce a new factor into war I quite foresee, and others foresee the same thing as well. But the attitude of a general in command of troops is that he has so many complications already, as regards the organization and operation of his troops, that he cannot very well encumber himself with another unless he feels sure that it is going to be of proved value. Of course people must not run away with the idea that a country which does not throw itself whole-heartedly into this new question of aerial navigation is turning a cold shoulder towards the whole problem. And yet this is, I am afraid, the view of a good many people as regards England. Our attitude as a people towards things in general rather predisposes us to such a view. Because one or two of our well-known military men have thought it wise to criticise the wild claims that have been made as to the use of aeroplanes in warfare we have got the reputation of having no interest in this subject, and of throwing cold water upon any experiments which have been suggested. The reverse is the case. Personally I am not at all sure that the wisest policy in the end will not be to carry out quietly and thoroughly such experiments as will permit us to keep abreast of scientific knowledge, and to delay a general construction of aerial machines until we feel

more sure than we do at present which is the best of type for military work. Against any such policy as this there is, I know, the retort of those who would say, 'But suppose a war breaks out to-morrow, what will you do against a country which has already a large fleet of aeroplanes?' The reply to that is that it is the intention of the authorities to equip themselves with a fair number of machines of all kinds so that in case of any sudden emergency they will not be left in any way helpless. And it is a very useful policy also, and one which we are pursuing, to have an adequate factory ready for the making of machines quickly and thoroughly when a definite type has been resolved upon. It is even more useful, in preparation for the establishment of regular air-corps, to have a large number of officers and men well trained for aerial work, and ready to handle machines of all makes. All this preliminary work is being carried out. Men are being got ready. Machines are to be tested. Reports are to be made upon them. In fact everything is to be done save build a large number of machines. Why we should not do this is, I think, pretty clear. If one equips oneself with a large fleet of aeroplanes of any known type, such as are available to-day, they would almost undoubtedly prove obsolete in a surprisingly short space of time. In such circumstances we should have to build all

over again. I can hear the remark being made that any government should be quite prepared to do this. The criticism would be a fair one were existing machines absolutely practical so far as their use in war is concerned. But they are experimental. During the summer of 1911 there is no doubt that a far more useful machine from the military point of view will be available. Therefore it would have been foolish, a few months ago, to have yielded to a popular cry, and to have encumbered ourselves with a large fleet of aeroplanes.

"The conclusion was jumped to, quite early in the history of aeroplanes, that the conquest of the air had been absolutely attained. This was not, of course, the view of experts. It was the view of the public, more or less, and it was also the view of a great many people who took upon themselves the task of writing to the papers and asking why England was not provided with an aerial fleet.

"Many very vital points were entirely omitted by these people, who took such an enthusiastic view of flying. That machines could only fly when the wind was low was a point not considered at all. That engines frequently broke down; that landing could only be effected on certain ground; that the machines were tremendously bulky and extraordinarily frail — such points as these were quite diregarded.

"When a man had flown for 3 hours these enthusiasts argued as though they believed that a machine could fly for 3 hours at any specified time and in any sort of wind. From this attitude it is, of course, very easy to condemn any authority which hesitates, even for a month or so, in embarking whole-heartedly in the construction of aeroplanes.

"What our authorities in England may be blamed for, if they are to be blamed, is for having proceeded with a great deal of caution. That they have not realized that the aeroplane will become a very important factor in warfare I cannot admit. Everything I have seen and heard proves the contrary. But what is wanted now, above everything else, is a diligent training of men to fly. Any country which holds back a little from the making of large numbers of aeroplanes, with a view that all machines are at present experimental, and that a whole fleet will have to be rebuilt in a few months' time, must, from the point of view of its own safety, embark very seriously upon teaching a whole corps of men the art of flying a machine.

"The value of this policy can, I suppose, readily be seen. It is possible with a well-equipped factory, and with all materials to hand, to build a large number of aeroplanes in an exceedingly short space of time. This fact has been worked out by those who do not advocate

a large policy of construction at the present time.

"But what cannot be done in a hurry, however grave the emergency, is the training of men to fly. Therefore, what any country wants to do is pretty plain. It needs to purchase a fair number of aeroplanes, representing the principal types which have been successful, and to detail a certain number of promising men to fly these machines. From their reports as to their progress, and as to the performances of the machines, a great deal of valuable data can be acquired as to the most promising forms of construction for military work.

"When once a country has a large number of men ready to take the air without delay a grave element of danger is removed. After the training of men, the next step, of course, is to build a thoroughly practical aeroplane for military use. I think as regards the year 1911 that a good aeroplane for war purposes will be evolved. What can be done, apart from actual construction on the part of a Government, is for encouragement to be given to the makers in a country to experiment with, and devote time to, the evolution of a reliable and portable machine for military work.

"Here one sees a good opportunity for people of private means who have more than once come forward to assist the movement. In France these

prizes to encourage military machines have already been offered. But, in this case, there has been no waiting for private enterprise. The prizes have been offered by the War Department itself. Thus a maker can feel sure that if he produces a good machine he will be repaid for his trouble.

"Before I turn to another point as regards flying in its relation to war it will be as well, perhaps, to condense in a single sentence the attitude of more than one conservative government as regards the aeroplane. It may, in a few words, be put as follows: 'Until an aeroplane can be relied upon to carry out what military authorities would require of it under war conditions, they cannot be bothered by adding it to their many responsibilities.'

"I must say that the progress made with aeroplanes, during the time I have studied them, has been extremely hopeful. I have seen one difficulty after another overcome by the sheer determination of those who have been in the forefront of the movement. For example, the seemingly hopeless task of obtaining a reliable motor for aeroplanes has been surmounted extraordinarily well. It is no exaggeration to say that, at the present time, the best types of aeroplane motors are almost as reliable as those that are fitted to motor cars.

"This, from the military point of view, is

highly important. Progress has to be noted, also, in connection with the airman's ability to fly in winds. Although a great deal yet remains to be done in this respect, I have seen many flyers battling with breezes of a velocity of 20 and 25 miles an hour. Long flights are being made, also, with passengers. It is hard, in fact, in view of recent flights of more than eight hours, to quite appreciate what progress has been made.

"After coming back from some of the flying meetings of 1910, I found, in fact, that it was hard to regard the aeroplane any longer as an experimental machine. After seeing flights made day after day, often in unsuitable weather conditions, and with unfailing regularity, one seems almost to realize that what was once impossible is now being made possible.

"What the future tests of the aeroplane will show, I think, as regards military work, is its value in reconnoitering work to disclose the formation of an enemy behind a line of troops thrown forward as a sort of screen. Cavalry, of course, have a great use in reconnoitering work, and organization can carry this work to a very great pitch of perfection. Cavalry scouts will, for instance, locate for a General the position of a first line of an opposing force.

"But what they cannot do as a rule is to probe beyond this first line. They cannot tell

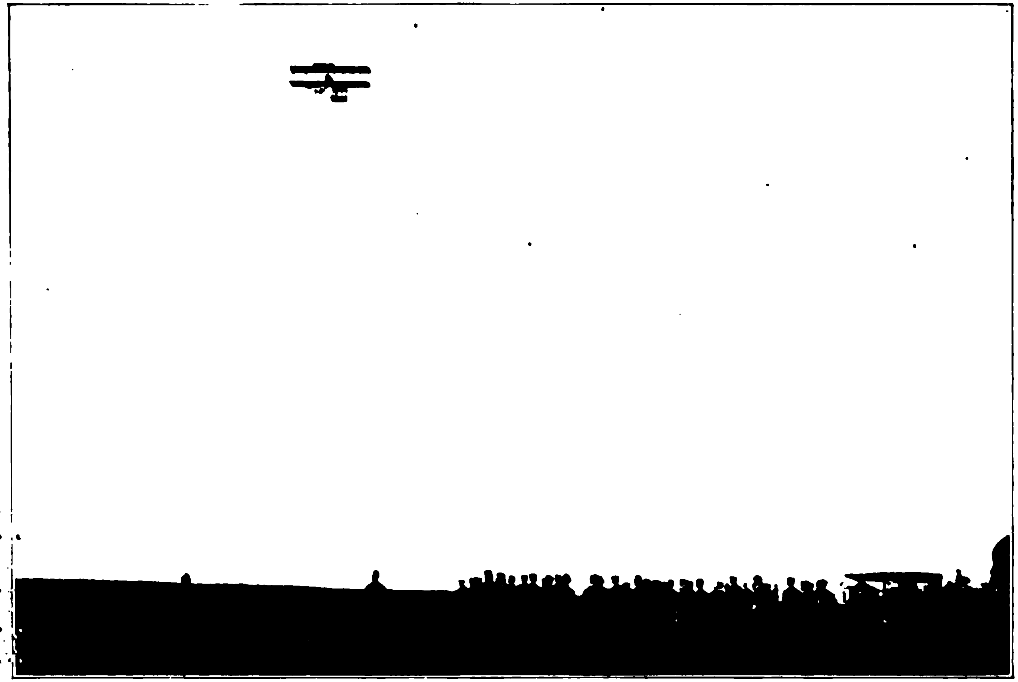
him one thing that he is particularly desirous of knowing — the way in which the General opposing him is massing his troops behind the mask of his advance guard. In this respect, as I have often argued with military men, the aeroplane has a very great opportunity.

"Rising from some suitable spot it will bear aloft an observation officer. He will order the pilot to mount until he has attained an altitude from which he can see right over the enemy's first line, and can detect exactly the direction in which the bulk of the troops are being concentrated.

"Then he can descend, and impart his information to his commanding officer. How vitally important such news as this might be one need hardly emphasize. Let me, for example, quote a case which came within my own personal knowledge during my campaign in China. We were held up for 5 hours without being able to help ourselves just because we had no means of estimating the exact strength of an enemy which was barring our way, and which was in occupation of a village.

"Having no information, it would have been foolish for us, under the circumstances in which we found ourselves, to have forced our way ahead. So we waited, although the 5 hours' delay meant a great deal to us.

"At the first aviation meeting I attended this



Mr. Grahame-White dropping a "bomb" from his Farman biplane, at the Harvard-Boston Aviation Meet, Atlantic, Massachusetts, September, 1910

predicament of ours came into my mind. It occurred to me that, had we had a portable aeroplane as a part of our equipment on that occasion, we could have sent an airman off, and have had a report back within practically a few minutes. What he would have been able to tell us was what we found out ourselves only by very devious means. It was that the enemy were more or less 'bluffing,' and that they had no real strength at this position at all."

In some final and very interesting notes my military contributor adds:

"Not that scouting exhausts all the possibilities of the aeroplane in warfare. Dispatch-carrying, through the air, opens up an exceedingly new and useful field. In this connection I can, perhaps, make my point clearer if I again quote from an experience of my own. In this case, two columns of troops were advancing in order to deliver a joint attack upon an enemy. So far as I can remember, about 20 miles of country divided the two columns.

"But the point about it was that it was exceedingly bad country. There were mountains between us, and there were no roads to call by that name. To add to the complications, parties of the enemy were moving between the two columns. Under such circumstances any ordinary method of communication would have been — and indeed was — not only extremely danger-

ous for those carrying it out, but also very uncertain.

"And yet, in order that the two columns should work perfectly in unison, it was essential that we should keep in touch with each other. Here, beyond all else, an aeroplane would have been simply invaluable.

"Whereas cavalry would have been greatly bothered by the hills which divided us, an aerial messenger would not have minded about them at all. Nor would he have been perplexed by any question of the fording of rivers. Neither would he have troubled at all at the fact that there were small parties of the enemy between us.

"His high flying, which would have been essential owing to the hills over which he would have had to pass, would have taken him, no doubt, far above any bullets sent after him. In half an hour, had we been fortunate enough to have possessed such an aerial dispatch-rider, we could have sent a message from our column to that which was co-operating with us at the time. In a little more than an hour we should have probably received the reply of the officer with whom we had been communicating. How extraordinarily useful such quickly-carried news and instructions would very often be can only be appreciated by those who have been actually engaged in military operations.

"One of the most interesting tests I have seen was that carried out by Mr. Grahame-White at Blackpool, and to which reference has already been made in this book. The significant point about it, in my view, was the fact that Mr. Grahame-White carried four urgent dispatches through the air with an absolutely unfailing regularity. Had the conditions been those of actual war, and had the disposition of the troops been as we supposed, there is no doubt at all but that Mr. Grahame-White would have won for us our action.

"From the uses to which I have already seen the aeroplane put, it seems to me that it could be employed in a hundred and one ways to the aid of a force in the field. I can picture an army moving through a country that they do not know very well, and with an enemy lurking somewhere around them.

"It is urgent, before going any further, that they should have something in the way of definite information. Therefore, they invoke the aid of an officer, who has his aeroplane with him, and who is ready to go forth and reconnoiter.

"He flies on, let us say, for an hour, during which he makes a fifty-mile circuit of the land all around his base. Then he descends, and tells his commanding officer just those things about the lie of the land, and possibly also about the

position of the enemy, that he is most anxious to know. This is only one instance that occurs to me on the spur of the moment. One could, if one wanted to do so, duplicate them almost to any extent.

"In this essay I have not, so far, made any reference to the destructive powers of an aeroplane. In speaking of the destructive possibilities of the flying-machine, one means naturally the dropping of bombs by a pilot while he is flying through the air. Why I have not made reference to this subject is because no real proof is forthcoming as yet that such work can be carried out.

"It is true that, from an altitude of say 1,000 to 1,500 feet, an object can be released by the pilot of a machine with a good deal of precision. Studying this question with a good deal of attention, I have more than once seen tests carried out.

"But a thousand feet is scarcely high enough to be of much value as a test. It would mean that if a pilot, in actual war-time, dared to try any destructive work from such an altitude, he would expose himself to a most deadly fire from those from the ground.

"It is clear that a pilot's height, in order to give him anything like a margin of safety, when gunners are seeking to bring him down, should be from 3,000 to 5,000 feet. And I have not

seen or heard of any conclusive tests that bombs can be dropped from an aeroplane, with accuracy, from such a height.

"Personally, however, judging by experiments that I have seen, I should say that any projectile can be let fall from an aeroplane with a good deal more accurate aim than any skeptics imagine. At Blackpool, for example, I saw Mr. Grahame-White release a number of bags of flour from varying altitudes, and his aim was very good.

"But in each case, however, he was not at a height that would have permitted him to have escaped gunfire directed at him from below. Many more tests, and tests of a far more ambitious character, are necessary before one can agree with enthusiasts that the aeroplane has any big future as a destructive factor. What one wants to prove is that projectiles can be released from a machine when in flight from a height ranging from 3,000 to 5,000 feet. If this can be done, the subject merits the very closest consideration.

"I should now like to say a final word. Already, granted ordinarily favorable weather — that is to say, a wind of not more than 20 or 25 miles an hour — any airman sufficiently expert can demonstrate conclusively that aircraft have become of unquestionable use in modern warfare.

" But it must, of course, be remembered that airmanship is in a period of transition. What the future will bring forth we have yet to see. But from my own observation I am convinced that the aeroplane is destined to play a most important part in the warfare of the future."

CHAPTER XVII

AVIATION MEETINGS AND THE ELEMENTS OF THEIR SUCCESS

One of the most remarkable features of the development of the flying movement has been the fact that, with scarcely any exception, public demonstrations of airmanship have proved a financial failure.

How great a failure some of them must have been is indicated by the statement made to me not long ago by one of the organizers of several of the principal meetings.

"Although," he said, "it is difficult to obtain precise figures as regards all meetings, one may say definitely that not far short of £100,000 was lost in England by the promoters of flying displays during the season of 1910."

When one considers that mechanical flight is the very newest thing in the world, and that it was estimated that people would flock in thousands just to see a machine in the air, this lamentable loss of money is very remarkable.

I have talked to a good many well-informed people about it, and have formed a good many

conclusions of my own as to why it was this money was lost.

The trouble goes back a long way. Directly anything new is introduced into the world to-day people come along to exploit it. There are financiers always who are quite willing to form companies and run concessions if they think there is money in any novelty that may be devised. Directly the first men flew, it was decided by clever people that there would be a great deal of money in the organization of flying meetings.

But what really happened was that the aeroplane was exploited publicly on a large scale before it was sufficiently perfect to give practical demonstrations. The result was easy to trace. At the first meetings that were ever held people came long distances, and spent large sums of money, in order to see machines in the air. Had it been possible to provide them with a thoroughly good day's amusement there is no doubt but that the flying meetings which followed would have been a very different proposition from the financial point of view.

But these early-type machines could not fly in any breeze at all. Therefore, unless the conditions were absolutely ideal, no flying could take place, although large crowds of people had paid their money to see flying and waited patiently all day long in the expectation of at last seeing a machine in the air.

Four machines in the air at once, Belmont Park, Long Island, New York, October, 1910. From left to right, Bleriot monoplane, two Wright biplanes and a Farman biplane

After one or two of these early fiascoes flying meetings naturally obtained a rather bad reputation with the ordinary public. The direct consequence was that, although the people who lived in the neighborhood of a flying ground were quite willing to come out and spend their money in the hopes of seeing a machine aloft, spectators would not take the risk of embarking upon a long railway journey when they felt sure that at the end of their pilgrimage they would only see a few minutes' flying, or perhaps none at all.

This fact was particularly noticeable as regards one or two of the meetings which were held in England. What ought to have been done, of course, was not to exploit the aeroplane for spectacular purposes until it was sufficiently perfect to have given demonstrations in almost any sort of weather.

But this, although an ideal which looks very well on paper, is not practical in such a world as that in which we live. The aeroplane was a brand new thing, and it has to be shown to the public with the least possible delay.

There is no doubt, however, had not these first meetings been in some cases such dismal failures as regards weather, a very different tale would have been told concerning the money made at the subsequent meetings.

Another point that played an adverse part in the finances of flying meetings was the fact that

enormously heavy expenses had to be paid before a meeting could be held. These preliminary expenses were scarcely understood by the men who organized the first meetings. In scarcely any case that I remember personally was the sum laid down in the first place for preliminary expenses adequate for the amount of money which had to be spent.

In one case, I remember quite well, the organizers of a meeting decided that a sum of £6,000 would be ample for the purposes of preparing an aerodrome, erecting sheds, and other such expenses. Their surprise and annoyance may be judged when I say that this cost of preliminary work totaled more than £12,000 before the aerodrome was ready for the public.

In many cases, when a flying ground was inspected, it looked to be most suitable for its purpose. But, after it had been finally decided upon, many difficulties were more often than not discovered. In one case, for instance, a number of ditches and fences, as well as a large piece of marsh land, had to be treated, at a cost of a good many hundreds of pounds, before an aerodrome was pronounced, by technical experts, to be suitable for flying purposes.

It is, of course, no easy matter to prepare a wide tract, perhaps three miles round, which shall be suitable at any point for an aeroplane to descend upon without damaging itself in any

way. This means that the ground must be smooth, and that there must be nothing in the way of an obstruction into which a machine might run.

Apart from the question of preparing the ground, upon which many of the companies organizing aviation meetings have had to spend treble the money they anticipated, there have been heavy expenses in arranging enclosures for the public, in building grand-stands, and in erecting a number of special sheds of a large size in which the airmen have housed their machines.

What all these preliminary expenses have meant, in some instances, one may indicate by the quotation of actual figures. In one case I know the cost of a meeting, organized by a large town, was estimated at all the committee meetings at certainly not more than £10,000. As a matter of fact, this sum was considered to be an outside one. All the calculations as to profit and loss were made, before the flying meeting came on, upon the understanding that the preliminary expenses would not exceed this sum of £10,000.

But what happened was that, instead of £10,000 being spent, the town had expended a sum of more than £20,000 before a penny was taken at the turnstiles. Although the attendance of the public was, in this case, quite satisfactory,

the result from the financial point of view was unfortunate. All the difference between profit and loss had been made by the fact that a miscalculation, on a very large scale, had been made as to the cost of organizing the demonstration.

A man who has recently had quite a unique experience of arranging flying meetings said to me apropos this subject:

"It is really dreadful, in view of our later experience, to think of the sums of money that were wasted at these early meetings. At more than half of them there was scarcely anybody who knew anything about flying at all. Money was spent most recklessly in giving inducements to famous aviators to compete.

"The arrangements of the enclosures, as regards the attendance of the public, were generally very badly done also. I remember that, at one meeting I went to, a very large space in the best position had been reserved for people paying a guinea for their tickets, while the half-crown and shilling people were crowded together in a very inconvenient part of the arena. The idea, in this case, seemed to be that rich people would be the principal patrons of the meeting, and that the crowd would not be present in anything like large numbers. As a matter of fact, the reverse proved to be the case. Ordinary people came to the meeting to pay a shilling and half-crown in very large numbers indeed. The

A race between an aeroplane (Farman biplane) and an automobile. Won by the former

result was that these enclosures were inconveniently crowded, with a detrimental effect upon the attendances at succeeding days, while the guinea enclosures were scarcely occupied at all. This is only one example of an error of judgment, but it is typical of many that were made in the early days of the flying meetings.

"I do not mean that any mistakes like these would have made all the difference between profit and loss. What the real trouble was, of course, was that people were asked to come at a certain time and at a certain place to see something that could only be shown them if the weather was absolutely favorable. The result was bound to be unfortunate. But if a greater discretion and skill had been exercised in the matter of these details there is no doubt that, in a great many cases, the losses upon meetings could have been very materially reduced."

Many of the first flying meetings had to handicap themselves very severely by paying large fees to aviators to be present. The attitude of the pilots, in this regard, was quite natural. I mention this because some of them have been blamed for demanding such high fees, in the early days of flying, that the financial aspect of the sport was ruined.

But they calculated that large sums of money in this field was only to be made for a short time. They realized, also, that the meetings were being

conducted purely on the money-making basis. So, seeing that they were taking whatever risk was being run, and were providing the spectacle that the people came to see, they felt quite justified in asking very big fees in order to perform.

Apart from what they asked themselves, moreover, it is a fact that organizers of meetings were competing so strenuously in arranging an attractive programme, that all sorts of extravagant offers were made to the flyers who had the best-known names.

Then, again, a great deal of money was spent upon prizes. There was, in fact, a tendency at first to devote quite ridiculous sums of money to the events which constituted a week's programme. These prizes proved a very heavy drain upon the resources of the promoters.

Generally speaking, the number of people whom it was expected to attract at these flying meetings was very greatly over-estimated. More than one promoter trebled, in his own mind, the actual attendance which there was upon any day of a meeting. At nearly all the first events the preliminary estimate of the number of people who would pay for admission was at least double that which actually proved to be the case.

The explanation for the lack of attendance at meetings is rather difficult to find. Most of those who studied the question in the early days believed that the sight of a flying machine would

have so potent an effect that great crowds of people would come together to witness any display.

What it must be, I think, is that people have refrained from coming to flying meetings, and paying their money at the gates, because they have feared that they would see nothing after all. This is really, so far as I can make it out, the only explanation why such a general interest is evinced in flying, and yet why so few people, apparently, will go out of their way at all to see a machine in the air.

The difference between expectation and realization in the attendances at a flying meeting is illustrated rather strikingly by some figures which I happen to have by me concerning the attendance at one of the meetings at which I flew.

In preparing their ground, and in estimating their gate receipts, the promoters had calculated that there would be a daily attendance of the public amounting to at least 50,000. What really happened, however, was that even on the best day of all during the meeting, when the weather was really fine, and a good deal of flying was done, the actual figures did not show an attendance of more than 25,000; and on one or two days when the weather was distinctly bad, and only one or two men made brief flights, the number of people present fell to as low as 3,000 and 4,000.

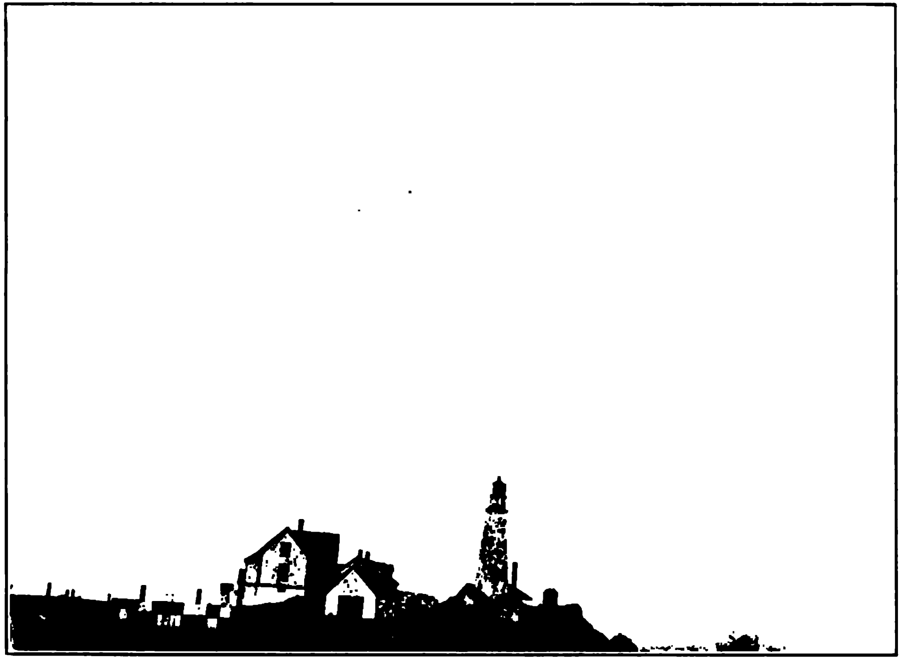
After estimating very carefully what this meant, one of the directors of the meeting observed to me afterwards:

"People seem to know now that flying is only possible when the weather is good. They won't spend their money and lose a lot of time in traveling only to find that the wind is too high for flights when they have reached the meeting."

At a great many of the meetings I have seen it has been quite clear that the public who have witnessed the flying have come almost exclusively from the districts immediately adjacent to the aerodrome. This was proved in connection with one meeting I was at. Here the ground had been chosen, in the first place, because it was a very good one, and in the second place because, although not situated close to any large center of population, it could be reached quite easily by train from a number of towns in which there were very considerable populations.

The meeting was a very well-conducted one, the programme was good, and the flying, in a general way, came well up to expectations. A great point had been made in arranging with railway companies to run a large number of excursion trains from the towns around to the aerodrome.

It was recognized that people might want to know in the morning, before starting away, what the day's chances of flying would be. So



Mr. Grahame-White in his Bleriot monoplane circling over Boston Light, September, 1910

a system was devised of having telegrams, describing the chances of sport, posted up in prominent positions in all the towns from which spectators were expected to come.

But the result was extremely disappointing. The special trains, although running very well, were scarcely filled at all, the meager attendance which was recorded consisting almost entirely of people who came from within easy distance of the aerodrome, and apparently did not mind wasting a few hours in the hope of seeing flights. But the people in the large towns further away evidently decided that the whole thing was too speculative for them.

I am reminded, at this juncture, that I should have mentioned before, while talking of the cost of organizing a meeting, that a very appreciable item of expense has always been the transport of the aeroplanes. A present-day aeroplane is, of course, a very bulky affair. A biplane, even when reduced to what may be called small proportions in order that it may travel by train, represents a "parcel" which is forty feet long and nearly ten feet wide. No ordinary railway truck will accommodate one, and in some cases the aeroplanes form such unusual luggage that they cannot be got through tunnels. In the ordinary way, when he is transporting his machine from point to point by rail, an airman has to arrange for a special truck. On steamships,

too, special accommodation has to be made to carry a machine. It is not surprising, therefore, to hear that in one case, when bringing a dozen biplanes from France to England, and in paying for their return to the spot from whence they came, the organizers of a meeting were face to face with an expenditure of as much as £1,500.

Among the hundred and one incidental expenses that may crop up when a syndicate has put its shoulder to the wheel and is organizing a meeting on a good scale, may be mentioned the predicament in which one party of organizers whom I know found themselves.

After spending a lot of money on leveling the aerodrome and in clearing away trees, besides erecting a number of expensive grand-stands, they were suddenly brought face to face with the fact that a very large number of people would be able to see the airmen perform by posting themselves in fields surrounding the track, without having paid a penny to do so.

There was only one thing to be done, and that was to raise some sort of fence so that the view of the unauthorized public was obstructed. This was done. At the last moment, and by dint of employing a number of men, a fence, made chiefly of canvas, was erected. This fence had to be made just seven miles long, and was at least 10 feet high.

As regards the amount of money paid away

in fees and prizes, I was told the other day that at five meetings this year a sum of at least £35,000 was secured by the airman taking part in these meetings.

Very largely contributing to the non-success financially of many of the flying meetings of 1910 were the following facts:

1. The enormous expenses of preparing very large aerodromes, some of them with smooth, three-mile flying tracks. 2. The high fees paid to famous flying men. 3. The fact that the public have not come long distances to attend any meeting, because they have feared a disappointment as regards flying.

As regards the future, many people who should know tell me that there will be no more flying meetings. Their argument is that the novelty has worn off. They do not think that people will pay any more to see flying. Upon this point, however, I am myself inclined to agree with them.

Many people have asked me why it is that in France people are so enthusiastic regarding aviation. My reply has always been that the interest that is taken in flying in France is almost entirely due to the fact that the people there have seen so much actual flying. They were able, so to speak, to take a friendly interest in the very earliest efforts that were made to fly. For the experimenters who were thus work-

ing so painstakingly they had also a friendly regard.

Thus the triumphs achieved by Frenchmen in the early stages of flight were regarded by Frenchmen generally as a tribute to the enterprise of their country. It was, in a way, a personal matter. Every Frenchman considered it his duty to encourage flying, because in flying France had taken so fine a lead.

In England, on the contrary, flying was for a very long time no more than a word. Frequent flights had been made in France before we ever saw an aeroplane in this country. The lead that France took in the question of airmanship rather damped our ardor over here, I think. At any rate flying was not taken up in England with any amount of enthusiasm.

I have even heard it said in this connection that flying as a project rather jarred upon the practical ideas of the people in England. It was regarded as being more or less of a myth. It is true beyond question that the first people in this country who took a keen interest in flying and tried to increase interest in it were treated in a very cold way. One may say, in fact, that flying had to be thrust upon us before we would accept it. Latterly, it is true, England has done much good work.

Contrary to the English attitude was that of America. When I visited America in the latter

Mr. Claude Grahame-White and Hon. John F. Fitzgerald, Mayor of Boston, at the Harvard-Boston Aviation Meet, Atlantic, Massachusetts, September, 1910

part of the summer of 1910, I was astonished to find the interest that was taken in all questions of airmanship. Here, indeed, was quite a different attitude. People were not sceptical, but full of enthusiasm. Their enthusiasm took a very practical form. There were clubs, I found, everywhere, and societies, devoted to the furthering of flight.

It would be difficult to hazard a guess as to the number of people who have built aeroplanes in America. Every town, almost, has its flying man, and is proud of him.

I remember quite well when the question arose of forming an aeronautical reserve, to be attached to the troops in America. This scheme was carried through with extraordinary rapidity. Instead of any official handicap or restriction being placed upon the idea, it was greeted with the greatest interest.

This, I suppose, is typical of America. At any rate, it impressed me very greatly, and I thought how fortunate the inventor must be who first introduces an idea to the American people. Flying has gone ahead in America with very remarkable strides. It is treated like other things are treated in that wonderful country. If there is anything in it, and if the Americans themselves decide there is something in it, it is pushed ahead with the greatest enthusiasm.

If, in England, such enthusiasm had been

evinced, flying to-day would be very much more advanced than is the case. The great complaint that has been voiced to me is the complaint of the inventor and home manufacturer, who has labored in vain to create interest in his work. It is curious, too, that even when flying has been demonstrated to English crowds there has not been so much enthusiasm as one would have imagined. In France, at the Rheims meeting, I remember the extraordinary enthusiasm of the people as one after another of the champions of the air passed by. Hats were thrown aloft, there were loud cheers. In some cases people wept in their enthusiasm.

But when the aeroplane was first seen in England I remember studying the crowds very attentively. It seemed to me that the wonder of flying, this achievement of man's after centuries of striving, was not being properly realized. The people did not seem moved or thrilled by the spectacle.

There seemed a lack of imagination on their part. This, I think, is due to the fact that people in England never thought that flying would ever be brought to such a practical use as has been the case. It is only such naturally enthusiastic people as the French who could strive against such great odds as they were striving against in trying to make a flying-machine.

But one consolation to us, in reviewing this

attitude of England towards the aeroplane, is that, once interest is aroused, the science in this country will go ahead very surely and very thoroughly. That such interest is being aroused I firmly believe. Everything points to such being the case. And once England has put her shoulder to the wheel, I am fully convinced that our leeway will be made up with astonishing rapidity.

CHAPTER XVIII

RECOLLECTIONS OF THE FIRST RHEIMS MEETING

It is interesting to go back to the feats which were performed at the first Rheims flying carnival. The men who flew then represented all that was best in connection with the infancy of aviation.

Let us take Paulhan, for example, who proved, at a later stage of his career, my successful opponent in the great flight from London to Manchester. Paulhan's flying was always wonderful. I remember that at Rheims he flew very high and very steadily, on one of the early-type Voisin machines. He was another man who was absolutely engrossed in the science of flying. His judgment, like that of Farman, was exceptionally good. He flew, too, with the greatest care. He was the type of man who exercises all sorts of wise precautions without appearing at all too careful. After achieving many successes at the Rheims meeting, Paulhan traveled a great deal in order to exhibit his machine and his capabilities to different people. After flying for a long time with the Voisin machine, Paulhan decided to be-

come a pilot of the Farman biplane. It was upon a racing machine of this type that he performed his memorable flight from London to Manchester. At the present time Paulhan is doing a very useful thing.

He has abandoned all flying, save tests to determine the value of new machines, and is devoting himself to serious constructional work. His aim is to produce a machine which shall be thoroughly reliable and useful for military work. There is a great field in this direction, and Paulhan's ideas are quite original. The first machine which he turned out was regarded with unusual interest, and quite rightly so. It was a biplane made to take to pieces with exceptional facility, and one which also comprised the first application of a system of reducing the surface of the planes to obtain greater speed.

One of the most picturesque figures at the great Rheims meeting was that of Hubert Latham. No pilot presented a more interesting study. He represented the studious man who had become interested in flying. His interest in it was profound. And it was not only the interest of the student, but the interest of the sportsman. Hubert Latham is a complex study in this respect. He would not suggest a hunter of big game, or a man ready to take almost any risk.

One would rather picture him as a student, fond of his books. As a matter of fact, no man who is flying to-day has a more splendid nerve

or a completer disregard for personal safety. A great fascination has always surrounded the Antoinette monoplane that Latham flies. This machine is beyond doubt one of the most striking flying crafts in the world. It has widespread wings and possesses a picturesque suggestion both of speed and power. Although others have gained skill in handling this particular type of machine, it is a fact the Latham remains the champion of champions in steering it. Undoubtedly the Antoinette requires exceptional dexterity in handling. Its original method of control, in which wheels are employed instead of levers, is mechanically most excellent, but it is a method which is somewhat difficult to learn. As a wind flyer, the Antoinette monoplane is almost unsurpassed, and Hubert Latham has achieved many remarkable feats in this field.

He is, generally speaking, regarded with admiration by all other airmen. The reason for this is that they have the greatest respect for his careless courage, also for his sportsmanlike behavior under all circumstances. Many times, since he began to fly, Latham has had accidents, but fortunately no serious results have followed. Undoubtedly the Antoinette monoplane represents a type of machine that is extremely safe. Its strength of construction, and the remarkably good position of the pilot behind its big wings, give him a great immunity from injury even should the machine be wrecked. In discussing the

Mr. Hubert Latham in his Antoinette monoplane, at Belmont Park, Long Island, New York, October, 1910, passing a pylon

Antoinette one must not forget a reference to its constructor. M. Levavasseur is one of the most conspicuous figures in the aviation world of France. He is a dreamer, and yet at the same time an extraordinarily practical man.

Leblanc, who flew so well at Rheims, has since become a great pilot. He is now one of the best known flyers of the Bleriot monoplane. Helping him to achieve success as a pilot, was undoubtedly his previous ballooning experiences. He has specialized lately in flying the racing monoplanes, which have been designed by M. Bleriot, his great friend. With one of these machines he made a splendid flight for the Gordon-Bennett Cup of 1910, which I managed to win in America. What brought M. Leblanc to disaster, in this contest, was the fact that his petrol tank ran dry.

We will now discuss Rougier, another of the pioneers who first came into prominence at the great Rheims meeting. Rougier had been a famous racing motorist. In appearance he is alertness personified. At Rheims he was seen as a pilot on a Voisin biplane. During the memorable week he achieved a number of extraordinarily good flights.

Subsequently, touring in the South of France, he achieved a number of excellent performances. Then he met with an accident that turned out to be very serious. While at Nice he was flying over the water. Suddenly, from a reason never

satisfactorily explained, his biplane fell sheer into the sea. Although the pilot was not seriously injured he sustained a shock which incapacitated him for a long time. Recently M. Reugier has embarked upon constructional work.

Another famous pilot at the Rheims meeting was Mr. Glenn H. Curtiss, who, with a biplane of remarkable lightness, was able to win the Gordon-Bennett speed race for America. One of the most noticeable things about Mr. Curtiss was his American coolness. He and his mechanics did just what was necessary, and no more. His machine, like the way it was handled, was extraordinarily neat. Since these early days, Mr. Curtiss has devoted himself very seriously to the improvement of the machine.

It is interesting, in this connection, to call attention to the gradual rise of the monoplane school of construction. It was not until after Bleriot and Latham had been making their flights for the *Daily Mail* £1000 prize for the cross-Channel flight, that the monoplane came into any prominence.

To compare the monoplane and biplane is a rather difficult task. Both machines are excellent in their own way. First, I will touch upon the advantages of the biplane. Primarily the feature of this machine is the strength of its construction. In the second place, it is easy to control. In the third place, it has a natural stability which is

quite a feature of this type of machine. One of the reasons why it is popular, I have no doubt, is the fact that it is easy to fly.

The disadvantages of the biplane may be easily stated. First of all, it is a machine that has come to be regarded as being slow flying. It presents awkward features also as regards its size. Many pilots do not regard it as an ideal machine for flying in winds.

The advantages of the monoplane are many. The reason that it has become so popular recently is that pilots have chosen it on account of its speed. A great many of the prizes offered recently in flying have been given to a machine performing a certain distance in the quickest time. For any such feats as this the monoplane is infinitely superior to the biplane. Large prizes have also been given for high flying. Here again, owing to its engine power, the monoplane has easily surpassed the biplane. Chiefly as a speed machine the monoplane has exceeded in popularity the biplane. It has also other advantages, and notable amongst them is the fact that it can be transported with great ease. This question of transport gives to the monoplane a distinct importance from the military point of view. Generally speaking, in the opinion of the greatest thinkers on the subject of aviation, the future of flight lies with the monoplane purely on account of its speed and its convenient size.

CHAPTER XIX

LEGAL PROBLEMS AFFECTING AVIATION

One of the most interesting aspects of flying is that which concerns the laws which will have to be framed, sooner or later, for governing the passage of aeroplanes from point to point. A great deal has already been written on this subject. Several important conferences have also been held at which many interesting opinions have been voiced, but in the main the question of governing aerial traffic will have to be left, more or less, to be settled when the art of flying has more fully developed.

A great many of the problems which arise are entirely new, and are very difficult to come to a decision about. It is a case of considering a great many things that may arise without anything very definite having happened to give any one a guide. Legal problems affecting flying have indeed been very few and far between. In my own case, I remember only one instance of any legal question coming up as regards the actual flying of a machine, and apart from any trouble arising, in a purely technical way, between makers and

flyers, or between flyers and the promoters of a meeting.

The case I refer to happened at Blackpool during the flying meeting held in August, 1910. There was, it appeared, a woman with her husband, sitting in a carriage outside the flying ground. The lady wore a very valuable coat. While they were sitting watching the flying, one of the pilots passed out beyond the aerodrome and flew directly over the carriage. As he did so a small quantity of oil fell from his machine and unfortunately alighted upon the lady's coat.

Her indignation, naturally, was very great. There was at once talk of claims being made against the promoters of the meeting, and also against the flyer whose machine had dropped the oil. But the claimants, in this case, found some difficulty in getting ahead with any proposed action. To begin with, seeing that the carriage was not inside the flying ground, but was standing on a public road some distance away from it, the case proposed against the aviation company fell to the ground. The difficulty of bringing a case against the flyer, whose machine had dropped the oil, was a very real one. No one, least of all the lady whose coat was injured, knew which flyer it was who had passed high overhead, and dropped the oil. Several pilots were in the air on this afternoon, and several were flying machines of the same type.

I heard no more of this action after leaving Blackpool, and I feel pretty convinced that, on account of the difficulties I have named, nothing more was done with it. One of the most interesting questions, as regard the law and the aeroplane, is the fundamental one of whether any one piloting an aeroplane has the right to fly over anybody else's property. The many opponents of the aeroplane, mostly conservative people, who do not relish its development, argue that an aeroplanist has no right at all to pilot his machine above the land of some one who objects to his presence.

The question which arises is, Can the aeroplanist be stopped? Here one gets into a regular legal labyrinth. All sorts of people hold all sorts of views, and there will be no real satisfaction until the question is brought up by some actual case coming forward. Then, and not until then, we shall have a sensible pronouncement on the subject.

What is often quoted is old Roman law. This old Roman law, obviously framed before anybody had any idea of the coming of the aeroplane, gives a man the right to own the air above his particular property, as well as the property itself. On this reasoning of course the slice of air, so to speak, which extends upwards from any back garden, belongs to the owner of that garden, with the result that unless the owner wishes it no aero-

plane can pass over it. Such a view, however, is of course not likely to be upheld. That is to say, it will not be upheld in its full force. Were any cantankerous person to have the power to prevent aeroplanes passing over his land, at however great an altitude, and with however great an absence of anything in the form of a nuisance, the development of flying would be very seriously hampered. A good many cases have been mentioned to me in which people might have a grievance because an aeroplane flew over their property.

In one instance cited to me, the case was taken of the owner of a very large game preserve, whose birds might be frightened by the whirring of an aeroplane engine passing overhead. And I have heard other arguments of a somewhat similar kind. But all these points will naturally have to be argued out by a perfectly impartial tribunal. It is clear that any arrangement that is come to, regarding the laws of the air, will need to be international in character. It will be no good for one country to have a series of laws, and for the laws of a country next door to differ from them.

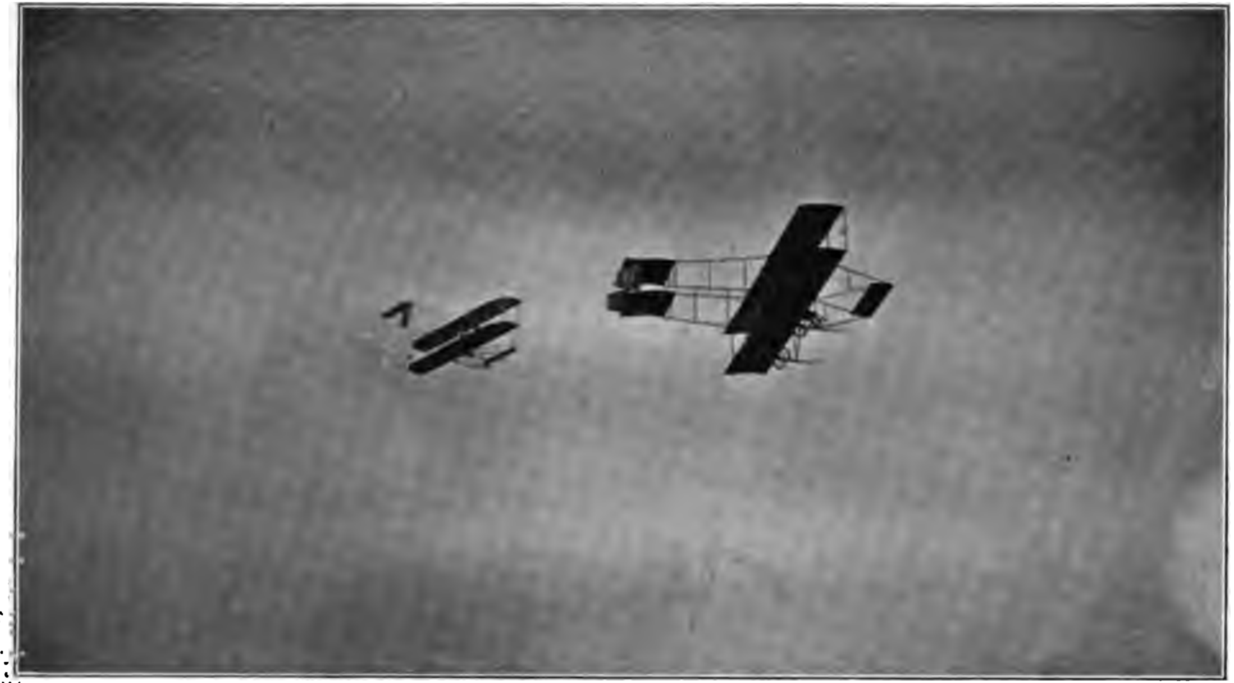
A very good move in this direction was made some months ago when a number of skilled arguers met in Paris as representing the chief countries of Europe. I remember that England was represented by several gentlemen from the Home Office. What this conference had to do,

was not to make any drastic decisions, but to discuss, generally and tentatively, the vast problems which the growth of aviation have brought forward. This conference, like all conferences of such a nature, sat for a long time and apparently did very little.

But it would be unfair to say, as a matter of fact, that very little was done. A good deal was done. All sorts of intricate questions were discussed from all points of view. Very valuable memoranda were drawn up, and then the conference was postponed. Pioneer work of this kind, even though it may lead to no definite results at the time, gives any conference that follows it a great deal of highly valuable material to work upon. The chief questions which provoked discussion at this conference were, I learned afterwards, those affecting the international control of aeroplane traffic.

As flying develops, as the number of aeroplanes grows, and as long flights become more and more common, it will indeed be an enormously important question which is opened up, as to the control exercised over a machine passing from one country to another.

To return for a moment to the question of how the traffic of aeroplanes over private land is to be regulated. This is an easy point, and one that is likely to arise, before we are greatly concerned with problems affecting international traffic.



A Wright biplane and a Farman biplane passing

How will a compromise be arrived at? for it is really something in the nature of a compromise which will have to come. It will never do for an airman to be prohibited, absolutely and without question, from flying over any particular piece of land. At the same time, it will certainly not be politic for no restrictions whatever to be imposed upon the aeroplane passing from point to point. In the early days of motoring I remember we were greatly troubled with a dreadful person who was known as the "road-hog." This individual made himself so generally unpleasant that self-respecting motorists were glad when legislation stepped in, and he was severely handled.

Although one does not yet foresee the advent of the "air hog," there is little doubt but that some infliction of this nature will eventually be imposed upon us. Even apart from precautionary measures, against careless and unthinking flyers, it will be imperative that the people on the land should be safeguarded from anything in the nature of oppression.

As things stand at present, flying is a thing that touches the imagination of nearly everybody. There is the friendliest possible feeling towards airmen, and the hope is very generally and honestly expressed, that aviation may progress rapidly and become of general use to mankind. This feeling has come about in a very

natural way, and it is a useful feeling to have inculcated into the public mind at this early stage.

There is all the difference in the world between having public opinion on your side or against you. So far flying men have had every right to expect that the sympathy of the world should be with them. They have worked extraordinarily hard. They have risked their lives daily, and many of them have spent large sums of money in the cause they have taken up. And what has been their object? They have merely been striving to perfect a science which, apart from their own personal triumph, will be of inestimable use to mankind, should ultimate success come.

This, as I have said, is a very nice feeling to have established between the public and the flying community. But it is very easy — almost fatally easy — for a good impression like this to be dispelled. This is why sound and wise legislation is so necessary, at a fairly early stage, in the serious development of the flying movement. One or two bad disasters, in which large numbers of the public might be involved in serious injury, would turn sympathy, on the part of a large mass of people, into resentment.

And such accidents, when flying becomes common, may very easily take place unless the greatest precautions are taken as regards the flying of machines. I do not mean for a moment that anything in the nature of repressive legislation

should be advocated. Far from it. Many industries have been seriously hampered by having a great many restrictions imposed upon them.

What I wish to see is a practical form of flying code to safeguard not only the public but the men who fly. And in the compilation of any rules of the air I would suggest that practical airmen, as well as the ruling bodies of flying, and legal luminaries, should be called upon to discuss what is best to be done.

Regarding any troublesome person who might try to prevent any aeroplanes flying over his land, a friend of mine remarked the other day: "It would be all very well for such a person to make up his mind to prevent flying over his property, but how is he going to exercise this right? Imagine an aeroplane passing over him at a height of two or three thousand feet and traveling at a speed of perhaps 80 or 85 miles an hour. How would he manage, either to have this flying machine stopped, or having failed to stop it, how is he going to bring the offending pilot to book?"

There are of course many very interesting problems of this nature which await decision. It is scarcely likely that problems affecting flying will be speedily solved. For one thing the air is an entirely new medium for human travel. All the laws regarding it will have to be framed from a new point of view. Legal opinion will have a very fruitful field for endless discussion. I have

been amused on more than one occasion lately, to find with what avidity some lawyers have already prepared themselves for the advent of aerial disputes. They evidently think that there is going to be a great deal of profitable business attached to disputes and squabbles concerning aerial traffic.

And I have no doubt, myself, that a great deal of time and money will be wasted before we have what one might call a working code, to legalize the passage of flying machines from point to point. For one thing, I feel pretty sure that the argumentative person who seeks to keep all flying machines from passing over his land will have difficulty in having this view upheld. What is very likely, I imagine, is that a sensible sort of compromise will be arrived at in this respect.

What the organizations interesting themselves in airmanship will have to prepare for is a campaign against oppression on the part of those who think that it is dangerous to fly, and a wicked thing to open up the air as a new method of transit.

I think I can now turn from this subject to one which is more interesting. I refer to the movement, that has already been discussed, to establish regular "airways" for the convenience and control of aerial traffic.

The "airway" is designed with the purpose of providing one fixed and regular route, by

which aeroplanes and airships may pass, say, between two important towns. This question of an "airway" came up at the conference in Paris, to which I have already referred. Here practical authorities gave their opinions respecting it, and it was decided that the whole question should come up again at a further meeting.

The idea which lies behind the suggestion of an airway is fundamentally a very sound one. The scheme for having an airway would simplify, very greatly, the marking of the route between any two towns. In this connection there is very little doubt but that such marking will be done. I hope to make reference to this later on. The idea of the "airway" comes in, of course, in arranging a route, say, from London to Manchester. In choosing the route it might be possible, and probably would be possible, to arrange it over country best suited for flying.

A point that was raised at the international conference, in this connection, was that an "airway" should be laid down partly with the view of carrying the aerial traffic over parts of the country upon which least damage would be done, should an aeroplane be compelled to make an involuntary descent. This certainly struck a good many people who heard it as a reasonable point of view. As a matter of fact, there is little doubt but that the policy which has already been laid down, of discouraging flying over towns, will be maintained in the future.

Therefore, in drawing up an "airway," say from London to Manchester, it will no doubt be deemed necessary to divert it, when possible, so that it does not cause the air traffic to pass over towns *en route*. Of course there will be a great deal of flying, for short distances, across country. For such short flights no fixed airways would be necessary, or indeed practical.

In such a case, without doubt, restrictions will be imposed upon the pilot as to his method of flying. He will, for example, be required to maintain a certain altitude, and he will also, without question, be told to avoid passing over any congested neighborhoods. By carrying out such precautions as this there is no doubt that a great deal of the risk of flying could be obviated. Of course it must be realized that in a very short time there is a great deal of flying to be done.

People have not yet accustomed themselves to the idea that before more than another year or so has passed aeroplanes will be passing overhead as quite an ordinary occurrence of every-day life.

One of the most interesting and at the same time most difficult legal problems, in connection with this rapid growth in the number of air craft, will be that effecting compulsory descents. There is little doubt but that, when a large number of machines are passing from point to point, a fairly appreciable percentage of them will have to make

landings at any unexpected place, owing to mechanical troubles.

The point naturally arises as to what damage will be done by these compulsory descents. This point was, I remember, discussed very seriously, some time ago, by committees of the aero clubs of various countries. It seemed to be held then that the only way out of this difficulty was for a fee to be settled, which an airman, descending unexpectedly upon any piece of land, should pay the owner of that piece of land. Of course this idea is merely given in its bald outline.

That something of the kind will have to be done there is little doubt. Frequently, I imagine, it will not be the actual descent of a machine upon a piece of land, which will be the cause of damage, but the trampling on the land by people who come to see the machine, and probably the taking to pieces of the machine before it can be removed from some bad landing point. There is, of course, a precedent in this respect in connection with ballooning.

Here you have frequently the case of a balloon descending upon a farmer's crop. It may be that, in doing so, the balloon itself does not do any very great damage. But before the balloon is removed from the field it falls in, and before the crowds can be prevented from swarming over the fields near by to see the unusual sight, a considerable amount of damage has been done.

In such a case it is generally a matter of arrangement between the farmer and the ballooning party. It has never been considered necessary to have any special understanding in this respect, seeing that such contingencies have not occurred with sufficient frequency.

But with the aeroplane it will be quite a different thing. Involuntary descents will be made very frequently, and there will, without doubt, be all sorts of claims for damages cropping up. Thus a perfectly clear scale will have to be drawn up, and adhered to with legal severity. Of course there will be the two points of view to consider. The airman must be safeguarded against improper charges, and the landowner or individual will have to be safeguarded also against not obtaining proper recompense for any damage done to his property. But above all such minor points as this looms the question of how aerial traffic is to be regulated, as it passes between countries.

Here indeed is a problem which will require the most careful study before it can be solved. So far, in the more or less impromptu discussions which have taken place regarding it, the fringe of the subject has only been touched upon. One of the most debatable phases of the new air traffic will be the method employed by the customs, on the various frontiers, in maintaining their control over the incoming and outgoing craft. Here, it is generally held, the "airway" will play its

part in helping to solve the question. From one country to another there will, it is generally agreed, be but one air path.

Airships going from the capital of one country to the capital of another, will pass along a specified international air route, and will, in particular, be called upon to cross the frontier at a precisely indicated spot. This will, of course, facilitate the customs in the collection of their dues.

Without doubt, however, should ingenious wrongdoers decide to exploit the aeroplane for this purpose, a great deal of smuggling will be possible, in what one might call the early days of the commercial development of the aeroplane. By having "airways" between countries, and especially by having regular air "controls" at frontiers, it seems probable that Government police and customs will be able to keep a check upon the number of machines passing in and out of their country.

Of course one of the chief dangers which governments will seek to guard against is the danger of a foreign aeroplane passing unobserved over their frontier on a spying expedition. This will be obviated, no doubt, by having all frontiers patrolled regularly by protecting aircraft, which will have the express duty of preventing all strange craft from passing into the country. In order to keep close track of all aeroplanes in various countries it was suggested at the recent con-

ference in Paris that each country should exchange a list of aeroplanes, very carefully made up, and corrected from time to time.

In this way it was thought each country would know what was approximately the extent of the world's air fleet. Apart from such a question as this, however, it will doubtless be necessary to number, carefully and completely, all aircraft that are in existence as soon as the numbers reach anything like an appreciable total. In this respect many suggestions have already been made. It is held, in the first instance, that there should be a clear and definite distinction between private aeroplanes, public craft, and military machines. This can easily be done by numbering each type of airship or aeroplane in a distinctive way. Apart from the question of what particular airship or aeroplane is in question there will come the point as to what nationality the craft belongs to. Here, again, some distinctive token will have to be selected. It will be sufficient, I imagine, for an aeroplane to exhibit a flag of its country. Apart from questions of nationality and character, the aeroplane will need to be licensed for identification purposes, in the same way as a motor car is licensed to-day. But there will be a more difficult question, in this regard, than the mere numbering of the machines. The point that will arise is whether or not the number the machine bears will be visible from below. This problem

has been argued in all its aspects more than once. With an aeroplane as at present constructed it is no easy matter to fix upon it a number which can be seen readily from the ground when the aeroplane is passing at a good speed overhead.

One of the most important aspects of flying, in its immediate future, is the way in which it is to be controlled by the bodies in various countries which have supreme authority placed in their hands. It is necessary, in order to understand how flying is governed, to make a reference to the supreme body or council which, through accredited representatives, has absolute authority.

The body with these great powers is the International Aeronautical Federation. It is a federation composed of representatives of the Aero clubs of all countries. These clubs elect so many members to represent them at the meetings of the Federation. Here various ideas are discussed and many important decisions made. The Federation, apart from its powers in deciding all questions that arise, grants to aviators, through the clubs in each country, the certificate which, after a certain number of flights, is given to a pilot as an indication of his proficiency.

All great contests and aeroplane events of a sporting character are held under the control of the Federation, which draws up the rules for them. As an instance, I may mention the Gordon-Bennett International Speed race. In 1910 this

was held under the auspices of the Federation in America. As the result of my winning it, it is to be held this year in England. A committee of the Royal Aero Club of the United Kingdom was, after my victory, appointed to prepare plans for the contest, and to select a suitable ground.

This method of governing flight has so far proved quite practicable. The importance of such work cannot very well be over-emphasized. An autocratic and ill-advised controlling body may do any growing science an infinite amount of harm.

It is instructive to note the change that takes place in the character of the flying events from year to year. In 1910, for example, the programme of the year was mainly comprised of meetings and spectacular demonstrations of flight. These, in view of the stage of progress in which they came, were extremely useful. Each of them played its part in educating the public to the importance of flying.

This year, however, a new spirit is prevailing. From the spectacular we find we are turning to the practical. This is a very necessary and useful change of ideas. The aeroplane has progressed so rapidly that what it needs now is that every possible encouragement shall be given to develop aspects which will help forward the commercial side of the movement.

Aerodrome flying, which was the feature of 1910, was interesting. It also gave large numbers

President Taft and Mr. Grahame-White at the Harvard-Boston Aviation Meet,
Atlantic, Massachusetts, September, 1910

of people an opportunity of seeing aircraft in flight. But what is now needed is encouragement of cross-country flying. To this end one sees that the majority of the contests of 1911 are tending. Cross-country flying is, indeed, far more valuable at this stage of the industry than flying round and round an aerodrome. Had the policy of continuing to stimulate aerodrome flying been carried out during 1911 it would have the effect of evolving something in the nature of a freak machine.

Towards the end of 1910 most of the flying at meetings was in the nature of speed racing. To produce these speed machines, makers fixed big engines to very small-winged monoplanes. This type of construction can be carried to great extremes, providing manufacturers have one thing in their favor. High-speed machines, unless provided with a means of varying their pace, can only be operated on aerodromes where they have a perfectly smooth landing-ground. Thus it will be seen that, had this aerodrome flying been continued, machines would have developed which would have been useless for any other purpose save for racing under artificial conditions. What cross-country flying will do, however, is something quite different. In most of the events of 1911 it will be seen that speed still plays a most important part. But, owing to the fact that the contests are to be decided across country, and not round and round an aerodrome, quite a new set

of conditions are imposed upon the makers of the machines which will take part in them.

Not only will the machines have to fly fast, but they will also have to make descents, if necessary, on grounds which are not smooth. They will have to land in fields, and perhaps on any sort of open space that presents itself. This means that any frail, specially-light racing machine would not be strong enough to stand the shock when coming into contact with anything like rough ground. Therefore, makers are busy with a type of machine which is far more practical in character than any freak speed machine destined for the track and nothing else.

It is probable, indeed, that the contests for 1911 will have an enormously important effect upon the future of the industry. What is to be built is a strong machine, and at the same time a fast machine, and above all a reliable machine.

Three more useful features than this could not very well be combined in one machine. It is already quite clear that the Aero Clubs of the various countries will have an extremely arduous flying season during 1911. Not only in numbers, but in importance, and in the difficulty of the technical questions raised by their rules, will the flying events of this year be memorable. If one looks through a list of the various events that are down for decision, one is struck by the amazing advance in flying which the majority of them indicate.

In the summer of 1909, when the first Rheims meeting was held, it was considered a wonderful thing for an aeroplane to fly a good many times without coming down round and round an aerodrome. For it to do this the weather had, of course, to be perfect. And now one of the principal events for 1911 is, I see, an aerial tour of some of the capitals of Europe. This contest has been seriously drawn up, and will be seriously undertaken by a large number of pilots.

I do not think one could have any more striking illustration of the progress that has been made in a period of only two years. It is interesting to consider the effect upon public opinion of such prizes we are to compete for during this year. What they will emphasize is the growing practicability of the aeroplane, and this, without question, is the point that needs being emphasized.

The whole aim of builders now is to construct an aeroplane which shall be entirely practical in all its features. In England, during the year, apart from the Gordon-Bennett speed race, the outstanding feature will be the *Daily Mail* £10,000 prize for an aerial tour of Great Britain. The effect of this contest, both upon construction in England and also upon the interest of the people of the country in flying, will be remarkable.

Already special machines are being built to take part in the race. Already, also, in the towns throughout the country which will be visited by

the airmen local committees are being organized to arrange about the landing grounds. Local prize funds are, also, being formed, so that special awards may be made to the competitors for meritorious feats performed while *en route*.

The most popular of these local awards seems to be that for the fastest time made while upon any particular stage of the race. Thus, as the time for the race draws near, the whole of England will be interested in it. There is nothing better, either, than for people actually to see a flying machine. This has had a more stimulating effect upon them than any amount of literature on the subject of flight. The reason, or at least one of them, why France is so enthusiastic about flying is that the people of France are thoroughly accustomed to seeing aeroplanes in all stages of development.

CHAPTER XX

THE FUTURE OF AVIATION

In talking of the future of flying, a subject that one naturally comes to when one approaches the end of such a book as this, I am reminded of the remark that was made to me not long ago by a very famous man indeed. After listening to what I had to say about the things we had already done, he said, "Aviation, indeed, foreshadows developments that are amazing. Who knows where it may lead?"

That summarizes, to a great extent, my own feelings. Where will it lead? One can, as a matter of fact, only speculate. But it is possible, I suppose, to do a little more than this, when one takes into consideration what has been done and what is being done. From this point of view one is entitled, I should think, to say something about what may be done.

I was immensely struck, not so long ago, by a prophecy which was written by a journalist who had had unusual opportunities of studying the aeroplane. This was his glance into the future.

"Now we will imagine that we are in 1920! We see a strange aero station on a bleak stretch of sea-shore. Resting motionless, with her bow pointed seawards, is a great, slim aerial craft — a veritable cruiser of the clouds. She reminds one irresistibly of the lines of the beautiful craft piloted by Hubert Latham across the Channel, and also at Rheims and in England. But she is infinitely greater and more powerful. Between her two wide-spread, supporting wings is a long, tapering body. This is like the hull of a ship. One can see that there are windows along it; it is evidently divided up into cabins and separate decks. And along the top of the graceful hull is a deck with railings around it. People, one notes, are moving about upon this deck. Gangways run on to the body of the airship from two wide platforms on either side of it. On the fore part of the ship is a raised structure, sloped over to offer a minimum of resistance to the wind. In it, moving quietly behind outlook windows, are several men in uniform — evidently the captain of the airship and his officers. A long train comes gliding to the side of the aero station. Immediately there is a tumult of embarkation upon the airship; then bells clang. The people disappear below from the deck of the aerial vessel. One after another a series of propellers at the airship's bow begin to hum with lightning-like speed. There is the

roar of machinery from the interior of her hull. She glides rapidly down a long, wide slipway which stretches seawards. The body of the cruiser one can now see is supported on little trolleys which run on guiding rails. For a hundred yards or more, heading seawards, the aerial vessel speeds along its slipway. Then, with a swift, sure rise, she is aloft. The humming propellers whirl more swiftly. The ocean-going aeroplane heads out to sea. It is at a two-hundred-mile-an-hour speed that she darts from England to America. Rushing unflaggingly through the air, thousands of feet high, she will have crossed the wide Atlantic in less than 20 hours. And to-day we speculate when a great liner brings us within 4½ days of New York."

This, I need hardly say, is a journalist's view. It is the view of one who jumps to an ideal, conveniently skipping over the intervening difficulties. Will such a day as he pictures come?

If you asked any man who has studied flying at all closely, he would answer "Yes." Then, if you ask him, in addition, the question "When shall we see such an air-liner as is described here?" his reply, if he were perfectly truthful with you, would be, "I do not know."

It is, indeed, a fact that nobody knows how soon it will be before flying becomes of commercial use. It is generally the unexpected that happens in regard to the air. Take, for ex-

ample, the beginnings of flight. After men had been striving for centuries to produce a heavier-than-air machine that would actually fly, the magic secret was obtained with dramatic suddenness.

It was all a question of power, and when a suitable power was to hand men found no difficulty in flying. There was no mystery about it. It simply meant that what was wanted was a propulsive force as light, and yet as powerful, as the petrol motor. And so, when people are apt to pooh-pooh the possibility of the ocean being crossed at very high speed by aeroplanes, the best thing to do is to refer them to the astonishing stride which flying made directly the right motive-power was to hand.

It only requires some equally important stride to be made in the future for the construction of large air-lines to be an accomplished fact. I do not think we need calculate that the petrol motor, excellent as it is, represents the last word in the propulsion of flying-machines.

All sorts of experiments with new types of internal combustion engines are constantly being made. I should not be at all surprised, any day, to find that an engine had been discovered which was infinitely more powerful than the petrol motor, and yet at the same time much lighter. Were such an engine procurable, the whole aspect of flying would, of course, be revolution-

ized. Far stranger things than this have happened. I feel quite sure that, before we have heard the last words on the subject of flying, some quite new motive power will be employed. Were it so, there would be no very great imagination needed to see the day coming which my journalistic friend pictures in the extract which I make herewith from one of his prophecies:

"An electric train bears us a few miles out from the congestion of London. We mount high upon a strange structure; it is an aero-express station. Here upon the beginning of a straight slipway lies another aerial craft. She is of the same type as the first one, only less capacious. "London to Manchester" — the destination of the airship is indicated by an electric sign. Business men come hurrying up; the fare is high, but the airship's luxuriously-equipped cabins are thronged before she glides out into the air and darts away — again at an amazing pace. Speeding high over town and country, the airship swoops down, and comes to rest at another aerial station upon the outskirts of Manchester. The business men glance at their watches with satisfaction. The aerial journey has been made in several minutes less than an hour. To-day we pride ourselves mightily upon speeding between the two great cities by express train in three hours and a half. Dotted around the

metropolis lie other aero-stations. Liverpool has also been brought within an hour's journey. Glasgow is now only two hours from London!"

Many problems are, of course, involved before any such machine as has been described above can become an accomplished fact. Apart from the question of the engine, there are many other important considerations involved. There is the very vital one of how the machine shall rise and land again. This may, perhaps, be arranged in the method that has been described in the quotation I have made above. Then there is the very significant question of how the engine power is to be transmitted. With present-type propellers a great deal still remains to be done. Their efficiency is not yet what their makers would desire it to be.

So far, the only method of construction employed in aeroplanes has been that of wood, canvas, and wire. Metal has been tentatively tried, but, for many reasons, it has not been a success. The principal reason is that makers of aeroplanes have not had at their disposal the necessary power to make proper use of it.

Metal construction will, without doubt, be heard a great deal of in the future. In fact, if greater speeds are to be attained, and that is the whole object which makers have now in view, it is essential that metal should play its part in the building of machines.

When speeds of a hundred miles an hour come into question, it is a fact that wood and fabric will not be equal to the strain imposed upon them. Therefore, although men who predicted the use of metal for aeroplanes were made great fun of a year or so ago, it appears pretty evident that their prophecy will become true. It all resolves itself, again, into a question of power. Given an engine which will provide him with a great amount of power for a very little weight, the maker of an aeroplane can do wonders. At present, with engines of 50 and 100 horse-power at his disposal, the constructor has a limited field for his advancement. He can, it is true, make very definite strides forwards as regards increasing the speed of a machine. He can also make it very much stronger than it was when the power given him was less. He can even embark upon the construction of a machine to carry four people, but beyond what one might call these modest efforts he finds his field of progress very restricted.

As a very well-known expert said to me the other day apropos this question of the future of flying: "We are now, I think, in the hands of the builders of engines and the makers of propellers. The future is with them. If the makers of engines can produce one of a very much greater power, and if the makers of propellers can produce a propeller which will make

effective use of the greater power given, then there is no reason why one should not increase the size of machines almost to an unlimited extent."

But, even at the present time, when we are, so to speak, on the threshold of the possibilities of the aeroplane, we are very near the realization of such a scene as is depicted below, and which is supposed to represent what happens in the year 1920!

"We see a country house in a well-wooded park. A man in a big coat, wearing a fur cap, steps through some doors upon a terrace, crosses a lawn, and walks towards what appears to be an elongated motor-car garage. Two women, warmly clad, are with him. The doors of the building are opened. Out glides, under the persuasion of a leather-clad chauffeur and two assistants, another and still lighter type of the slim-winged bird. There are seats below it. Out upon a drive, at the side of the mansion, the machine is wheeled. The man and the two women take their seats, the women with unconcerned laughter. They muffle themselves snugly with rugs. There is again the unmistakable whir of powerful machinery. At the front of the machine a propeller flickers with immense speed until it is lost to sight. The aerial chauffeur steps nimbly upon a seat at the rear. With a swift, crunching run across the gravel drive

the machine is in the air. It speeds across country, swiftly and surely, passing over hill and dale until another fine country-house looms in sight below. Then it dips — dips down sharply. It touches ground and rolls up another drive. It pauses at a fine portal. Out down the steps runs a merry party. The three visitors, breathless and exhilarated, are escorted into the oak-paneled hall. Tea is served! An afternoon call by aeroplane is now an accomplished fact."

How rapidly the aeroplane has progressed is, indeed, indicated by this quotation I have made above. This incident is not supposed to happen until the year 1920. As a matter of fact, both Latham and Santos-Dumont anticipated it last year. Mr. Latham made several calls at the houses of friends in his monoplane, and Mr. Santos-Dumont surprised some friends in a country-house by arriving through the air to pay them an afternoon call.

If the prophecies of enthusiasts can be anticipated in small matters, there seems some probability that they may be in large ones also. At any rate, however fast or however slow the progress of flying may be, that it will make progress until it becomes of world-wide importance is the absolute conviction of all those who are interested in it. Of course one of the greatest of all futures of the aeroplane is in connec-

tion with aerial warfare. Here, again, I should like to make a quotation from the prophet to whose writing I have referred before. His description of what the future will bring forth in the way of aerial warfare is imaginative, and at the same time tinged with a great deal of practicability. He says:

"A naval review is in progress in the home waters. Behind the array of the fleet come steaming long, low craft with wide decks cleared like floating docks. What are they? Suddenly, along the deck of one of them, a slim gray shape glides. It moves more swiftly, then rises abruptly in the air. It circles above the battleships. Another follows, and another. Soon half a dozen twist and turn above the ships of war. They wheel into line in the air and move from one point to another with precision. They are aerial cruisers and reconnoitering craft — long dreamt of, now realized. They whirl away at a tremendous rate. Then, an aerial expedition ended, they come darting back to the parent ships, gliding down upon their decks. We turn to army maneuvers inland. In a hollow in a wood a small army of engineers are busy upon a construction which has come to the spot in many wagons. Presently their work is done. They draw back. There comes a sound of whirring machinery. The shape, again with wide-spread, bird-like wings, rises swiftly. There are men

upon its deck — and guns too. Over a party of troops, whose hiding under cover is vain in face of such an assault as this, the machine hovers, almost standing still one moment, then darting ahead again. There are puffs of smoke from the deck of the airship, and the rattling report of machine guns. Moving like ants below men tend long-barreled, deadly-looking guns, which point rakishly skywards, and which follow the swift movements of the airship above. Then, sweeping up almost from nowhere, comes another slim, quickly moving shape. The two aerial craft, wheeling round and round each other, move away higher and higher in a crescendo of firing."

This is, indeed, a very dramatic picture of what we may see in the future. That the aeroplane will be developed in its destructive capabilities no one for a moment doubts. But its first uses, beyond question, when it is called upon in the warfare of the immediate future will be to carry dispatches, and to reconnoiter the enemy's position.

Afterwards, however, as machines become larger and more powerful, I see no reason at all why guns should not be mounted upon them. In such an event we should perhaps have the scenes actually carried out which are pictured above.

Nothing could be more beneficial than an air-

race conducted right through a country. These big contests of 1911 will provide many interesting features. Regular teams of flyers will take part in them. The most remarkable organization will be necessary, both on the part of the officials, and as regards the competitor.

In fact, more than one expert airman has already expressed the opinion that the races will be won, all other things being equal, by the man who has taken the trouble to equip himself with the best organization.

This organization on the airman's part will take the form of arranging with great care that his depôts for obtaining petrol are well arranged; that his machine is overhauled with the greatest care when he makes a halt; and that, should an accident befall him, spare parts may be rushed to his assistance with a minimum of delay.

In America, as well as in other countries, a great many valuable prizes are to be competed for. Notable amongst them, of course, is the Hearst $50,000 award for an aeroplane flight from the Atlantic to the Pacific, via Chicago, or in a reverse direction, to be made within a month.

Many people are beginning to compare the present stage of aeroplaning with some of the early days of the motor-car industry. There is, indeed, a great similarity between the two. But, at the same time, there is a difference. In the motor races, which can be compared with the

long-flying races we are now about to embark upon, the net result, although undoubtedly beneficial, was the production of a more or less freak car. In the flying-races of the immediate future my hope is that the general tendency will be towards the production of a practical machine. The point of most interest, when considering the effect of cross-country flying upon the industry, is that only a practical sort of rough-weather machine will answer satisfactorily under such conditions.

It is remarkable to reflect upon the value of prizes in furthering such a young industry as that of the aeroplane. The experimental work they are called upon to make is a constant drain upon the resources of manufacturers.

And yet, if they do not persist in this research work, progress becomes irritatingly slow. But it is only human nature that the makers of aeroplanes, and not only the makers but the men who risk their lives in putting to the test the makers' ideas, should be stimulated by the offer of valuable rewards for any meritorious feat that they may perform.

In preparation not only for the flights which have taken place, but also for those which are to come, the makers of aeroplanes in Europe have willingly spent many thousands of pounds. What this experimental work has meant in the production of improved apparatus it is almost

impossible to say. But what one can say, without fear of contradiction, is that had it not been for the public-spirited offer of so many prizes, aeroplane progress would have been very much slower than has been the case.

Upon this question of the amount of money that it is necessary to spend upon experiments before an aeroplane is considered sufficiently practical to place upon the market, a good deal of misapprehension exists. I have heard many men say, when looking through an aeroplane catalogue, and finding the price of any notable machine, "Why, it should be possible to build a machine like this for half the price."

Such a remark is easily made, but it shows a lack of reasoning power. One cannot maintain an experimental factory, employ large numbers of draughtsmen, waste months of your own time, break up machines, and damage engines, without its costing you a very great deal of money.

More than one manufacturer whom I know has devoted more than six months' persistent work to experiments with a machine before dreaming of asking anybody to buy one of them.

I may, perhaps, make this point clearer if I quote a specific case. An amateur airman was conversing with the maker of a well-known type of engine. Quite good-humoredly, the airman was protesting against the high cost of aeroplane engines. The conversation then turned upon the

production of a special motor of 300 horse-power which the pilot said he wanted in order to carry out some special flight in which very high speed was necessary.

"How much will you charge me," he asked, "for such an engine?" The aeroplane engine-maker answered that he could not fix any price at all.

Then he added: "Let me tell you this. In order to build such a new type of engine as would be necessary to produce 300 horse-power for aeroplane work a great amount of preliminary tests would be required. I calculate that it would take me eighteen months to build a satisfactory engine of the type you mention. During that eighteen months, although you may not believe me, my experimental expenses would amount to not very far short of £15,000. Naturally, you might ask where would the money go. It is not difficult to tell you. Before I was able to get the details of such a new engine all in satisfactory working order I should have to make, only to "scrap" again, quite a number of complete engines. You can, therefore, understand that a maker does not feel inclined to launch out upon a new type of engine unless he feels pretty certain that there is going to be a good demand for it."

For such costly experimental work it must be obvious to every one that a very definite incen-

tive is necessary. One of the greatest needs in the immediate future is for special prizes to encourage the building of an aeroplane specially designed to fulfill military requirements. In this respect one can feel nothing but admiration for the admirable attitude of France.

Already, from the flying we have seen in 1911, there are lessons to be learned. There is this lesson, for example. The engines of aeroplanes have now become practically as reliable as those in motor-cars. Instances, almost every day, are to be found to prove this. Naturally, in this connection, one may cite the recent feat of M. Prier, — one of the most able pilots of the Bleriot monoplane.

Taking his seat in his machine at Hendon, on the outskirts of London, early on a fine April afternoon, M. Prier sped across the southeast of England at more than 60 miles an hour, crossed the dreaded English Channel in a little more than a quarter of an hour, and arrived at Paris in time for tea! To be exact, his time of transit was 3 hours and 58 minutes. Adding to the wonder of the feat was the fact that M. Prier averaged a speed — again to be precise — of slightly over 63 miles an hour.

This flight made people think. Such proofs of the growing practicability of the aeroplane are, I know, causing all thinking men to ask, "What will the immediate future bring forth?"

Mr. W. Starling Burgess

Every day, with their personal skill and courage growing, and with steadily improving machines provided for them by the makers, airmen are able to carry out more ambitious flights.

There was, I might mention in this connection, the demonstration which I, and others, were able to give of the reliability of the aeroplane on the recent boat-race day. When all London was lining on the banks of the Thames, waiting to see the Oxford and Cambridge crews flock by, they heard unexpected sounds in the air, and, on looking upward, saw half-a-dozen aeroplanes circling above the river.

The proof of reliability, in this regard, lay in this fact: all these aeroplanes were able to carry out a pre-arranged programme, leaving certain starting-points, descending at other places, and following specified courses over the river, and all the pilots were able, without hitch or hindrance, to return to their starting-points.

Here, again, was a lesson — and an indication of what the busy flying season of 1911 is likely to bring forth. One more incident I may, perhaps, be permitted to mention before broadening my subject. On Easter Monday, being due to open an aeroplane exhibition at Bourneville, near Birmingham, I decided to discard the train and fly there, — a distance of 115 miles; and, despite a high wind and local fogs, I managed to carry out my scheme. Here was another object-lesson,

as I meant it should be, of the practicability of the aeroplane.

Now as to the topic of even wider interest,— the extraordinary growth, since the commencement of 1911, in all the military significance of the aeroplane. France, possessing in the first instance some 20 or 30 machines, has increased her air-fleet, by leaps and bounds, until it stands, at the present moment, at a formidable total of close upon 150 war aeroplanes. Nor is she content with this; by the end of the year, beyond all doubt, she will own 200 machines, with pilots, observers, and all the organization necessary to form a new and a highly-important "arm" in modern warfare.

By dint of incessant practice, her military pilots and observers have already reached a high state of efficiency. Winds of 25 miles an hour do not prevent them flying. Their machines are so reliable that they are able to carry out, almost daily, reconnoitering flights over 100-mile tracts of country. Her aerial observers have been trained to draw maps and make notes, while in an aeroplane, and to reconnoiter with accuracy from varying altitudes.

Exactly what stage of perfection France has reached, in this development of military flying, none but those who have studied her progress closely can adequately realize. She now has a new "arm," either of defence or offence, which

will be absolutely invaluable to her in time of war. A fleet of military pilots and observers, with reliable aeroplanes, provide the Commander-in-Chief of an army with the most perfect "eye" that has yet been given him. Information as to the enemy's movement he must have. Modern war makes reconnoitering vastly important; and the aeroplane, in an hour, will bring information that cavalry scouts would require a day to go in search of — and then might not obtain.

Wireless telegraphy must not be forgotten either, in connection with the amazing work done since the beginning of the year. France, the enthusiastic, again performing pioneer work, has obtained wireless messages from a military aeroplane in flight over a distance of more than 10 miles.

How valuable this would be to return to headquarters to make his report, the aerial observer, using his "portable" wireless equipment, will flash back the message of what he sees to a receiving station, without an instant's delay.

Not only in France, but in other countries as well, the military aeroplane has, since the beginning of 1911, gone ahead with mighty strides. Russia, suddenly awakening to the value of this new war weapon, has decided to spend £900,000 upon military machines. She will create a fleet of 300 aeroplanes before the end of the year,

and is already buying them in squads of 20's and 30's. Russian officers are learning to fly in large numbers; great activity prevails.

In Germany, too, the war aeroplane is now being developed with great energy. Temporarily neglecting the dirigible balloon, she is devoting herself assiduously to the aeroplane. First buying a consignment of 20 monoplanes, the German War Office is now credited with the intention of creating an air-fleet of 100 machines before the maneuvers of 1911, at which the Kaiser is said to be particularly anxious that there should be important aerial evolutions.

German officers are learning to fly with some secrecy as to the actual numbers passing through the schools. But it is clear that the intention is to create a very large air service in Germany. Inducements are being offered to military pilots in the form of prizes for long cross-country flights. Aerial reconnoitering is being carried on upon a definite and very practical basis.

Mention should be made, also, of the fact that Austria, Spain, and Italy are dealing energetically with questions of military airmanship. Regarding America, my latest information is that a preliminary sum of £26,000, voted so as to make a beginning with an air-service, is soon to be very largely increased, and that definite encouragement is to be given to American manufacturers. It is a gratification to me, also, to know

that the Aeronautical Reserve, founded during my visit to America in the autumn of 1910, is making remarkably good progress.

One of the possibilities of the immediate future, as foreshadowed since I wrote the beginning of this book, lies in the destructive powers of an aeroplane. Machines have been able to carry increasingly heavy weights. It is now possible for a war aeroplane to raise into the air a pilot, an engineer, and explosives to the weight of 500 pounds, and carry this load on a continuous flight of several hours. Although it is still to the reconnoitering possibilities of the aeroplane that military authorities attach chief importance, they are beginning to pay serious attention to the offensive uses of aircraft. They see that attacks upon supply stores, made with incendiary bombs, might be very embarrassing; also that troops on the march might be harassed and bridges and fortifications attacked.

In England, despite the determined attempts that have been made to arouse the authorities from their apathy, our aeroplane service for military work is woefully inadequate. At the time of writing, the War Office possesses not more than ten machines, several of them obsolete. An Air Battalion has been formed, but critics declare that an altogether insufficient sum of money has been allocated for aeroplane expansion, and that the year 1911 will be practically wasted, in com-

parison with the progress foreshadowed in other countries.

What the authorities in England have pledged themselves to do is to test the aeroplane, for war purposes, in the next maneuvers. These experiments they promise to make very complete and exhaustive, and they say that if the aeroplane emerges successfully from the ordeal to which it will be subjected, they will put the air service upon a more important footing.

In the maneuvers, which are to take place in Essex in September, it is clear that civilian airmen will have a chance of co-operating with the military pilots. I myself, with other airmen, will no doubt have an opportunity of showing the Army Council that the aeroplane is a thoroughly efficient instrument for military work.

A later word than previously written is possible, also, concerning the great contests of 1911. One aerial tour after another has been arranged, until there is now a sum of £200,000 to be won in flying prizes during the season.

In England there is now a probability of a keen contest for the *Daily Mail* £10,000 for a 1,000-mile race around Great Britain. Manufacturers are building special machines for the contest; airmen are making their plans for winning it. In France important contests of all kinds are being actively arranged. There is a race from Paris to Brussels, London, and back to Paris;

more races from Paris to Rome, and from Paris to Madrid. French makers are busy with special machines to take part in the official contests arranged by the Government, for which £48,000 is to be expended upon procuring aeroplanes to meet military requirements.

In America, naturally, considerable interest will attach itself to the attempts which will be made to win Mr. W. Hearst's £10,000 prize for the aeroplane flight from the Atlantic to the Pacific.

Already, in constructing machines to win these races, aeroplane makers have revealed what are to be the outstanding features of the machines of 1911. Certainly these machines will resolve themselves into two types. In the first place, we shall have a fast machine, capable in taking part in long cross-country races, and of averaging a very high rate of speed, — probably 80 or 90 miles an hour. This machine will not be a weight-carrier, and it will be as lightly built as is consistent with safety.

As a contrast to this racing-machine, there will be evolved an aeroplane for touring. Here weight-carrying capacity and comfort will be the prime considerations. High speed will not be sought. The machine will be strong and soundly built. The aim will be to produce, as a type, a regular air-car.

Some of these machines will be two-seaters; others will take three passengers and an "aerial

chauffeur." These two types will, of course, be distinct from developments as regards military aeroplanes. The war machine will be made stronger, and probably speedier, and capable of carrying a regular "crew" — consisting of pilot, engineer, and observer.

The development of a touring machine during the summer will greatly popularize cross-country flying. In this regard, Mr. Henry Farman, one of the greatest authorities upon the practical aspects of aviation, now lays it down as his mature opinion, that by aerial touring alone will the aeroplane be introduced to the world as a regular means of getting from place to place.

He, and others in France, are now striving to arrange for a series of aerial trips all over the country during the summer. It is intended that a party of aeroplane tourists should start away and occupy themselves with an aerial journey for several weeks, visiting beauty spots, and obtaining a bird's-eye view of the charms of the country below. To make such pleasure journeys by air really practicable, it is recognized that regular landing-places, at various points, will be a necessity. Therefore the makers in France, and the governing bodies of flight, are now doing all in their power to create "air stations" at chosen spots. At these stations the tourists will find a good landing-ground, with sheds for their machines, and with petrol depots and repair shops to hand.

With a chain of these necessary "air stations" conveniently arranged, aerial touring will become a thoroughly practical affair. The lead in France is being followed in England. Already more than one popular resort is considering the laying out of an "air station." Before the summer is over, the aeroplane "week-end," involving a trip from London to the seaside, will have become quite an established fact.

This aerial touring, once actively in progress, will have a very important effect upon the expansion of the industry. It will induce pupils to come to the flying schools. It will, in addition, tend towards the selling of a great many more aeroplanes. It will create, moreover, a deeper and more practical interest among members of the public in the development of flight.

Thus, indeed, we see the immediate future. Vitally important will be the military potentialities of the aeroplane. Then will come the effect of the great aerial races, allowing new machines to be tested and many improvements made. Finally, rounding off the work of the year, will come regular "air cars," and the institution of aerial touring as a new pleasure for the traveler.

CHAPTER XXI

COMMERCIAL POSSIBILITIES OF THE AEROPLANE

Not much has been said about the possibilities of the aeroplane for use with a fleet. As a matter of fact, nothing but tentative experiments have, as yet, been made. What it has been sought to prove in America and elsewhere, is that an aeroplane can be launched from the decks of a ship. The results have been favorable. The aeroplane, after leaving a special slipway constructed on the deck of the ship, has been able to fly back again and alight safely on the deck once more.

Personally, I see no great difficulty in this, providing that a sufficiently large space is allowed for the machine to run along on before it takes the air.

The greatest difficulty comes not in starting a flight from the deck of a ship, but in ending one there. In calm weather it is all right. But, where the pilot is confronted with the problem of a side wind when returning to the ship, he is rather awkwardly situated. He has a small

space only upon which to land, with a side wind drifting him away from it all the time.

All this question requires, however, is to be very well thought out, and for more tests to be carried out. In this connection, I hear that the authorities in France, alert as usual to any developments of the aeroplane, are building, or have already built, a special vessel with a landing-deck for aeroplanes upon it, which will be used during the coming summer in making just such a series of experiments as I have advocated.

The value of the aeroplane to a navy can scarcely be over-estimated. One can imagine a fleet steaming out from some port to find an enemy, and not knowing exactly where this enemy is. From a ship attending the fleet aeroplanes will be sent up. Their reconnoitering work would, beyond all doubt, prove of the greatest value.

What, of course, is most important — at least to those who are in the industry — is the commercial possibilities of the aeroplane. Here one finds that opinions are very much divided. Some people think that, however much it improves, the aeroplane will never be a competitor with land and sea travel as we at present know it. They do not hold this view because they think the aeroplane is not going to improve, but because they do not think that it will be a practical competitor with either of these means of transit.

Personally, I have thought these things out carefully. Here, at the end of my book, it would be as well for me to summarize these views, even though I have expressed some of them before when dealing with the various sections.

What is the demand to-day as regards travel? Everybody wants greater speed. "More speed" is the universal cry. In preparing their time-tables, the great railway companies strive to cut off a minute here and a minute there.

Business men, traveling from one city to another, will change their patronage from one railway to another because they find they can save, perhaps, a couple of minutes on a two-hours' journey. Every feat of fast railway traveling is acclaimed as a great achievement. But the limit, as regards railway speeds, is being reached. Unless some very radical change takes place, trains will not be able to run much faster.

And yet the demand for these increases of speed is insatiable. Of course there are systems such as the high-speed, electrically driven mono-rail train, which can attain very high speed. But, in regard to any such new systems as this, I am told that the question of expense in operating them would be a very big question indeed. As regards sea travel, speeds have been increased enormously in recent years. But here again one finds that a limit is being approached.

To gain any small increase in speed nowadays, the engine-power of a ship has to be enormously increased. The result is that the cost of running the ship becomes almost prohibitive. As a matter of fact, there has been a tendency lately, on this account, to reduce the speed of ships, and to increase their size and comfort. This does not, however, suit the keen business man who wants to get from London to New York as fast as is possible.

What we have got, therefore, is a demand for speed, and more speed, and yet with the providers of that speed being unable to keep pace with the demand. This situation seems to me to augur very well for the development of aerial traffic. In the air we have an ideal and at present an unexploited medium for the highest form of high-speed traffic. And it seems to me that we shall find that high-speed traffic through the air can be carried out at a very economical cost, as compared with anything like the same rate of travel upon the land. This is rather a controversial point, but I cannot see, myself, where the high-speed aeroplane of the future is going to be very costly in running.

To begin with, the aeroplane service, from point to point, would not be loaded down, as is a railway company, by the cost of its permanent way upkeep. The air route would be free. All that the aeroplane company would have to do

would be to provide itself with the necessary stations, and to equip its service with an efficient fleet of craft. Between points it would merely have the air in which to pass through. What exactly would be represented by the wear and tear upon an aeroplane passenger craft it is difficult to say. One does not quite see, for instance, what form of power might be used to propel one. As regards the wear-and-tear upon the machine itself, when passing through the air, I think this would be more or less a negligible quantity.

But the great thing to remember, in connection with the development of aeroplanes commercially, is that people are willing to pay well if they can be taken from point to point very quickly. There would, I foresee, be no lack of passengers if an aeroplane service could be established between London and Manchester, doing the journey in about half the time now taken by trains. Of course, what the passengers would need to be assured of was the safety of the craft. By the time a passenger-carrying machine of this size is an accomplished fact it may be taken for granted that the factor of safety will be a very high one.

It seemed a wild dream, not long ago, when people talked of crossing the Atlantic by aeroplane. I remember that Mr. John B. Moisant, an American airman who was killed on the last day of 1910, prophesied, when being presented

with a souvenir at the offices of the London *Daily Mail*, that aeroplanes would be flying across the Atlantic from England to America within a period of five years. Personally, I should not be surprised if this forecast of his came true.

The year 1911 will be fraught with great possibilities. If the variable-speed aeroplane, to which I have referred, can be made an accomplished fact during the year, and if reliable engines of a greater power are to hand, then the industry will go ahead with very remarkable strides.

As regards the variable-speed aeroplane, I am myself hopeful. I think it is only a question of careful experiment before this improvement is effected. If we can find a practical machine, giving speeds from twenty-five to one hundred miles an hour, the whole outlook will be immeasurably broadened. Primarily, of course, this high speed will give one the power to combat winds. In this regard it is curious to note that there are critics who declare that high-speed flying will not be so efficacious as has always been contended by practical authorities. Personally, I think that if a machine can be made to fly satisfactorily at a speed of one hundred miles an hour it will be able to weather any wind short of an actual gale.

Of course, the immediate development of machines of this type will be for use in military and

naval purposes. Then, afterwards, we shall find passenger-carrying services on an unambitious scale being put into operation. From this stage flying will go ahead very rapidly.

With increased engine power a greater solidity of construction will come into vogue. I foresee, then, that experiments will be made with metal machines. From this stage, if it proves practicable, there will be nothing much to hinder the evolution of a large, passenger-carrying craft. It is a fact, however, that most of the builders with whom I have discussed this question are inclined to think that for some considerable time at any rate the passenger-carrying machine will be limited to a capacity of about a dozen people. This restriction they place upon the future very largely because they are not yet sure of the power that will be placed at their disposal.

Of course, when a variable-speed machine of a practical kind is placed upon the aeroplane market, there is bound to be a demand for it from among people of wealth and leisure, who are, as a rule, only too ready to take up any new form of amusement.

There have been many adverse factors which have, so far, handicapped the aeroplane in any such field. To begin with, the prominence that has been given to aeroplane accidents has, naturally, had a very prejudicial effect upon what one might call the private demand for such craft.

The man of wealth, who enjoys driving his own high-powered and expensive car, would not do so, naturally, if he thought there was a very grave danger of his losing his life while at the wheel. Regarding aeroplaning, such a man believes that the danger is very great indeed. He reads the accounts of the accidents which have taken place, and he does not realize the very great number of men who have learned to fly.

Nor does he appreciate the fact that accident may be very greatly obviated, even with present-type machines, by only attempting flights when conditions are quite favorable, and by not making risky cross-country journeys over tracts of land where there are not good landing-spots should the engine of the machine give trouble. That there is bound to be what one may call a "boom" in aeroplaning I am sure. The only thing necessary is a suitable machine. If the makers can provide a machine which will get into the air at a slow speed, and which will fly fast when it is in the air, and still have an ability to return to the ground at quite a moderate pace, I foresee that such a craft is bound to be bought by others than professional flyers, or for military or purely trade purposes. One can gauge the interest of the ordinary person in flying from the remarks and demeanor of those whom one takes for an aerial trip as passengers.

In every case, I think, when I have taken up a

passenger, I have heard, at the conclusion of the flight, the most enthusiastic eulogy of the exhilaration of the new sport. It is, of course, a very different thing from motoring. It has a greater thrill. The sensation of power is indescribably fine. The objections to motoring, which are the question of dust on the roads, and vibration from uneven surfaces, are entirely absent in air travel. It is therefore, merely a question of providing the private purchaser with a safe and practicable machine in order to open up an extraordinarily valuable field for the new industry.

Regarding this point, one of the best known of the French manufacturers observed to me, quite recently: "I feel convinced that the aeroplane will, when the time comes, introduce to the world a greater industry than that which was created by the adoption of the motor car. Looking back upon the progress of motoring, and then comparing this with the development of the aeroplane, one finds that the progress of the latter has been far more rapid than was the case with the motor car. Yet the problems to be solved in connection with the aeroplane seemed, in the first instance, to be absolutely insurmountable. This astonishing rapidity in the development of flying is, of course, rather apt to bring about something in the nature of a check. During 1909, and most of 1910, the progress of the aeroplane was amazingly rapid. Then, towards the end of 1910,

things seemed to steady down to some extent. Machines and engines had reached a certain state of perfection. Flights of many hours' duration could be made. Engines were approaching the reliability of those fitted to motor cars. Because the science has stayed in this one stage, for a month or so, the rumor has got abroad that a serious crisis has been reached. As a matter of fact, all that has happened is that there is something in the nature of a breathing space rather than a reaction. Manufacturers are looking round to note what progress has been made and also what may be done in the future. It has become clear that the next steps forward are as regards the greater structural strength of aeroplanes and also in connection with their wind-flying capacities."

CHAPTER XXII

WHAT THE IMMEDIATE FUTURE WILL PROBABLY BRING

Utmost importance is attached to the question of improving the safety of machines by building them more strongly. A friend of mine, who has made an analysis of many of the aeroplane disasters which have occurred, has proved pretty conclusively that a very grave cause of accident has been the tendency of machines to break while in the air.

In fact, had it been possible to have had more strongly built machines during the past year or eighteen months, quite a number of the deaths which have been recorded might have been obviated. Fortunately there is no very great difficulty in increasing the strength of machines now that it is possible to carry greater weights in the air.

Builders have also learned many useful lessons, as I have said before, from the accidents which have occurred. The machine of 1911 will be a very much more practical and all-round craft than any of its predecessors. More attention will be paid to the comfort of those who travel in it.

Its controlling mechanism will be more carefully thought out. In its general structure, portability as well as strength will be aimed at.

One must not forget to make reference to the very important contests which will take place during 1911. The whole trend of these events will be to encourage cross-country flying. And speed, also, will be considered an important point. For the Gordon-Bennett race, which was won in 1909 by America, in the person of Mr. Glenn H. Curtiss, and secured for England by myself in 1910, a very notable meeting of champions is to take place in England, probably at the end of June, 1911.

The utmost care is being exercised by the Royal Aero Club of the United Kingdom in their selection of a ground for this contest. Owing to the very high speeds which will, without doubt, be attained, a three-mile course will be imperative. To secure this in England is no easy matter. Not only must the aerodrome so chosen be quite unencumbered by trees, but there must be, at all points of the course, a perfectly smooth landing place should a machine descend owing to engine troubles. It is hoped to hold this historic contest in the vicinity of London.

Another enormously important event which will take place during 1911 will be the great contest between European capitals which will be inaugurated by the Paris daily paper *Le Journal*. Dur-

ing the progress of this race the airmen competing will visit Berlin, Brussels, and London. One must not forget, either, the Hearst contest, in America, for a flight from the Atlantic to the Pacific.

One must not forget, either, a contest which will do enormously important work in developing the industry in England. That is the £10,000 prize for a 1000-mile race throughout Great Britain, which is offered by the London *Daily Mail*, and for which, without doubt, the world's airmen will compete. Many prophecies are being made as to the speeds that will be attained during the races of 1911. Personally, I think that a speed of 100 miles an hour will be achieved by some of the racing monoplanes taking part in these important events.

The aeroplane will not lack encouragement during 1911. In France, alone, I was told the other day that at least £100,000 will be devoted to aeroplane prizes. With this, and with English and American interest aroused, to say nothing of the demands made by governments, there is no reason at all why the industry should lag.

As one who has every confidence in the future of flying, I foresee that the next year or eighteen months will have enormous significance.

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